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THE DEMAND FOR DEBT FINANCE BY ENTREPRENEURIAL FIRMS

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Abstract:

We model the entrepreneurial firm's choice of debt finance, allowing for debt renegotiations in the event of financial distress. We differentiate two sources of debt finance, bank debt and trade credit, by the implicit equity stake that lenders hold in the borrowing firm. Lenders with a large implicit equity stake, such as suppliers, may adopt a more lenient liquidation policy for their debtors, but then set a higher price for their credit. Entrepreneurs, who have private information about their probability of financial distress, borrow exclusively from lenders with a small implicit equity stake, such as banks, only when the price advantage of bank debt outweighs the cost of a stricter enforcement of liquidation rights. Entrepreneurs who prefer the lenient liquidation policy adopted by suppliers contract only partial bank finance in order to avoid a potential default against the bank later on. We show that the fraction of debt that consists of bank loans depends upon the cash flow in the bad state, the value attributed to control rights and the initial wealth and risk aversion of the entrepreneur.

JEL: C70, G32, G33

I. Introduction

The benefits of bank financing have been documented widely in the finance literature, both theoretically and empirically. These benefits include screening of prospective clients (Diamond (1991)), monitoring (Diamond (1984), Rajan and Winton (1995)), efficient liquidation (Chemmanur and Fulghieri (1994), Repullo and Suarez (1998)), and efficient renegotiation of debt contracts (Smith and Warner (1979), Berlin and Loeys (1988)). Rajan (1992) was the first to point out that there are costs associated with bank financing: banks may obtain bargaining power over the firm's profits once projects have begun. This bargaining power stems from the information monopoly that banks develop during their ongoing relationship with their client firms. As a result, it is costly for firms to switch lenders, and banks can extract rents from their borrowers when renewing short-term loans. Even though competition ensures that the rents banks are expected to extract ex post are reflected ex ante in lower rates (Sharpe (1990)), bank debt remains costly because it distorts investment incentives.[1]

In this paper, we emphasize another cost of bank financing. We argue that banks may adopt a stricter liquidation policy for firms that default than some other credit providers do. The reason is that banks have a relatively small implicit equity stake in the firms to which they provide credit. Other creditors, such as suppliers, may have a larger implicit equity stake and, hence, may adopt a more lenient liquidation policy for firms that default. When entrepreneurs have private information about their quality, i.e. their probability not to default, we show that high quality entrepreneurs – provided that their quality exceeds a certain threshold – may prefer to borrow exclusively from banks to minimize their financing cost. Low quality entrepreneurs with substantial benefits from control, on the other hand, may limit their bank borrowings to avoid a potential default against the

[1] There is empirical evidence that supports the idea that banks exploit debtors during ongoing relationships. Petersen and Rajan (1994), for instance, find that bank relationships reduce the interest rate on bank loans to small firms by less than the true decline in cost from improved borrower quality. They interpret this as evidence that the information generated during the relationship is private to the lender and not transferable by the borrower to other financiers. Similar conclusions are made in Petersen and Rajan (1997). For large, listed firms, Houston and James (1996) find that firms, when setting their mix of private versus public debt, take into account that their monitoring lender may obtain an information monopoly if it is the only informed lender.

bank that would result in the liquidation of their firm. We develop this argument in a model of debt financing choices made by start-up firms. For new firms in traditional industrial sectors, the external financing sources usually are limited to debt financing, in particular bank loans and trade credit.[2] The results of the model, however, also hold for other types of debt financing that can be distinguished by their implicit equity stake, such as leasing.[3]

The key role of the liquidation policy of banks in structuring a firm's debt has been stressed before (e.g., Chemmanur and Fulghieri (1994), Repullo and Suarez (1998) and others). Our model, however, is driven by differences in implicit equity stakes and not by the lenders' differential information gathering abilities, as in Chemmanur and Fulghieri (1994) and Repullo and Suarez (1998). Furthermore, the impact of the liquidation value of assets and entrepreneurial wealth on the debt structure differs in our model compared to Repullo and Suarez (1998), where firms with a low assets' liquidation value and wealthy entrepreneurs rely less on bank finance.

While we argue that banks follow a strict liquidation policy, empirical studies have found evidence that banks, compared to public bondholders, tend to be more lenient towards firms in financial distress (e.g., Gilson, John and Lang (1990), Hoshi, Kashyap and Scharfstein (1990)). The common explanation is that public debt is difficult and costly to renegotiate, which could induce public debtholders to favor liquidation for firms that default, independent of whether or not this is optimal (e.g., Gertner and Scharfstein (1991)).[4] However, for new start-up firms, the public debt market is not a viable alternative for bank debt. Carey, Post and Sharpe (1998) is the first empirical paper to compare different types of private lenders. They find that banks tend to forsake from financing riskier borrowers and conjecture that both regulatory and reputation-based explanations might drive these results. Their explanation is *supply driven*, i.e. banks have reasons

[2] Berger and Udell (1998) discuss the sources of financing that firms can contract, according to firm age. In Continental Europe, venture capital can only be raised by firms in specific industries and venture capitalists typically finance firms in the growth stage (Ooghe, Manigart and Fassin (1991), Van Hulle (1998), Black and Gilson (1998)).
[3] After controlling for differences in the risk characteristics of borrowing firms, Carey, Post and Sharpe (1998) find that the rates charged by finance companies are similar to the rates charged by banks. Therefore, leasing companies could be considered as financiers who hold a rather small implicit equity stake in their borrowers. However, leasing is only available or some specific types of investments (e.g., Smith and Wakeman (1985)).

not to extend credit to firms that they perceive as being of high risk. Our model, on the other hand, is *demand driven*, i.e. we posit that entrepreneurs with important control rents may limit their bank borrowings to avoid defaulting against their bank. Instead, these entrepreneurs contract debt finance from creditors who hold a larger implicit equity stake in their borrowers and, hence, adopt a more lenient liquidation policy.[5] While Petersen and Rajan (1997) already suggested that banks and suppliers, due to a different implicit equity stake, might adopt a different enforcement of liquidation rights for firms that default, we examine the implications of such a different liquidation policy for entrepreneurs who decide on contracting debt finance. A related model is by Wilner (2000), who also argues that dependent (trade) creditors may grant more concessions in debt renegotiations than nondependent credit market lenders. Though, he finds that firms with a larger probability of default *unconditionally* are willing to pay the higher trade credit rate, while we find that this result only holds under specific circumstances, i.e. when the firm's liquidation value is likely to exceed its going concern value following default and when control rents are substantial. Furthermore, and unlike the model of Wilner (2000), we find that the optimal debt structure may consist of a combination of bank loans and trade credit. Also, this optimal debt structure is found to be firm specific and to depend upon the bad state cash flow, the value attributed to control rights, entrepreneurial wealth and risk aversion. Using data on a sample of 152 true business start-ups in the manufacturing sector, we provide empirical evidence that supports this theoretical model.

Our model develops as follows. We consider a risk averse entrepreneur who sets up a limited liability firm. The entrepreneur has insufficient personal funds to finance the input goods required at start-up and hence needs €1 of external finance. The funds can be acquired either through a bank loan or trade credit. The entrepreneur decides to contract a fraction a of external (debt) finance as trade credit, while a fraction $(1 - a)$ is borrowed from the bank. The purpose of

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[4] The literature therefore posits that private lenders are better suited than public debt providers are to finance firms that are risky and unknown.

[5] Franks and Sussman (2000) find that banks prove very tough in debt renegotiations with distressed SMEs and that trade creditors expand the amount of credit during the period of distress, even when it ends in formal bankruptcy. Also, Evans (1998) finds that trade creditors grant more concessions to customers in financial distress than banks do.

our model is to determine how the entrepreneur, having private information about her quality, will determine the size of the trade credit (a) and the bank loan ($(1 - a)$). As the market for bank debt is highly competitive (e.g., Amel and Liang (1992), Remolona and Wulfekuhler (1992), Benink and Llewellyn (1994)), banks hold only a small implicit equity stake in their borrowers.[6] Suppliers with a larger implicit equity stake in their debtors have a larger interest in the survival of their customers and, therefore, are willing to adopt a more lenient liquidation policy towards their debtors once the latter default on their claims.[7] Consequently, they attract the higher risk debtors and the price of trade credit will reflect that higher credit risk. This result is consistent with Petersen and Rajan (1994) and Biais and Gollier (1997), who find that vendor financing is more expensive than institutional finance.

First, we consider a *strictly constrained* entrepreneur who must invest all of her personal wealth in the firm (equity) to meet the minimum equity contribution for limited liability firms.[8] Our results show that the debt structure of the entrepreneurial firm is determined by trading off the lower price of bank debt against the more lenient liquidation policy of suppliers: high quality entrepreneurs, provided that their quality exceeds a certain threshold, prefer to borrow exclusively from the bank to limit their financing cost. Low quality entrepreneurs, for whom the strict liquidation policy associated with bank debt dominates its price advantage, demand only partial bank financing. These latter entrepreneurs limit their bank borrowings such that they will always be able to pay off their bank debt even if they become financially distressed, while allowing them to make maximum use of cheaper bank debt. We find that higher control rents increase the value of being allowed to reorganize following default, thereby increasing the lower limit on entrepreneurial quality for entrepreneurs to borrow exclusively from the bank.

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[6] Increased competition in the banking sector since the 1980s has been attributed to increased desintermediation, internationalization, changing customer preferences, and deregulation, which led to excess capacity for banks.
[7] We acknowledge that our model does not hold in highly competitive markets for input goods, where the supplier's profit margin on his sales is negligible.
[8] Note that entrepreneurs who cannot raise this minimum are not observed; these firms simply do not start up.

Second, we consider the situation where the entrepreneur is only *weakly constrained*: her personal wealth exceeds the minimum equity contribution for limited liability firms, but cannot cover all expenses so that at start-up, some portion of external finance must still be contracted. If the realized cash flows cannot cover the financial expenses at the end of the period, the weakly constrained entrepreneur might be able to bring in additional equity to facilitate a reorganization and, thus, prevent liquidation. We find that weakly constrained entrepreneurs have an incentive to limit their equity contribution at start-up to the minimum required by law – unless they wish to provide a quality signal – because of risk aversion. The separating equilibrium of the former strictly constrained entrepreneur model is preserved, but we find that the separating condition on entrepreneurial quality is decreasing in entrepreneurial wealth, demonstrating that wealthier entrepreneurs may prefer to borrow exclusively from the bank, ceteris paribus.

We also show that two additional separating equilibria result when the entrepreneur is only weakly constrained. First, if both high and low quality entrepreneurs find it too costly to borrow exclusively from the bank – because the bank will liquidate their firm following default – high quality weakly constrained entrepreneurs may still have an incentive to dissociate themselves from lower quality ones by bringing in more equity at start-up and/or increasing the fraction of debt finance that is bank credit; quality signaling will allow the high quality entrepreneur to minimize the price of external finance. However, the quality signal that is given by contracting more bank debt at start-up will only be credible if there is no doubt that once the firm becomes distressed, additional equity will be brought in to prevent liquidation by the bank; therefore, a specified incentive compatibility constraint should be satisfied. Given that this condition is fulfilled, we show that high quality entrepreneurs are indifferent between using leverage and the debt mix to signal their quality. Second, if both high and low quality entrepreneurs find it optimal to borrow exclusively from the bank at start-up, high quality weakly constrained entrepreneurs may still have an incentive to signal their higher quality by bringing in more equity at start-up. Though, we also show that when entrepreneurs have substantial personal wealth and highly value control rights, they may no longer be able to credibly signal their quality by means of their debt ratio.

Our model is developed in the remainder of the paper. In section II, we present the background of the model: the payoff characteristics of the project, the different players, the information available at the different stages in the game, the credit rates and the liquidation policy of the lenders. In Section III, we determine how a strictly constrained entrepreneur decides on structuring external (debt) finance. The weakly constrained case is presented in Section IV. Section V offers empirical support for this model. The final section of the paper offers some conclusions.

II. The Model

A. The Project

The firm engages in a one period project.[9] External financing through a bank loan and/or trade credit is required at start-up (time 0) to purchase input goods from a supplier. The project generates a (stochastic) cash flow that may be distributed among the creditors at time 1.[10] The value of this cash flow depends on the state of nature that has realized in the following way.

In the good state of nature, the cash flow available for distribution equals X_G, which is large enough to fully pay off all debtholders at time 1, independent of the debt structure that was assumed at start-up. The remainder of the cash flow is fully paid out to the entrepreneur (the equityholder). The project is considered terminated and the associated assets are liquidated at time 1 for a value of L, which is also distributed to the entrepreneur.[11]

In the bad state of nature, X_B is available for distribution among the creditors at time 1. Regardless of the chosen debt structure, X_B is insufficient to fully pay off all debtholders and hence

[9] As the project is a one period project, the maturity structure of debt is an irrelevant issue in the context of our model.

[10] This cash flow available for distribution among the creditors at time 1 is equal to sales: all operational cash flows, except for those input goods financed through trade credit and/or a bank loan, have already been financed at start-up (equity).

[11] $(X_G + L)$ can also be interpreted as the present value of a perpetual stream.

the firm defaults on at least some of its claims. Following default, the remaining debtholders must decide whether to liquidate or reorganize the firm. If they decide to liquidate the firm, L is distributed among the remaining claimholders at time 1 according to previously established priority rules; e.g., if the bank took out a mortgage on the firm's assets at start-up, L is first used to pay off the defaulted bank loan. So, while the entrepreneur has some discretion in the distribution of X_B between the firm's creditors, L is distributed according to previously established priority rules.

If the remaining creditors decide to reorganize their defaulted claims at time 1, they allow the entrepreneur to restart the project, which requires a new infusion of external funds to finance the purchase of new input goods. Since all cash available (X_B) has been distributed at time 1, these new input goods have to be financed with either new trade credit or a new bank loan. This new debt legally receives first priority on the project's cash flows realized by time 2.[12] In this case, the cash flow available for distribution at time 2 to the holders of the reorganized claims is X^r_G and X^r_B in the good and bad state, respectively. In other words, X^r_G and X^r_B are net of the repayment of the new debt that was granted at time 1: $X^r_{G,B} = \max\{sales^r_{G,B} - repayment\ of\ new\ debt, 0\}$, which shows that $X^r_{G,B}$ may not be sufficient to pay off the new and the reorganized debt at time 2.[13,14] Following default and reorganization at time 1, the good state of nature will realize at time 2 with probability δ, and the bad state with probability $(1 - \delta)$, in which case X^r_B equals zero (a normalization).

[12] This assumption is consistent with U.S. law whereby DIP financiers extending credit during a Chapter 11 reorganization obtain a *superpriority* status (Franks et al. (1996)). In Belgium, creditors who provide new funds during the court supervised reorganization procedure also obtain superpriority.
[13] Note that the new debt claims do not need to consist of trade credit: if the bank agrees to finance the new purchases of input goods at time 1, then the supplier faces no uncertainty concerning the realization of his implicit equity stake. Also, the bank claims originated at time 1 now have the highest rank and, thus, will be paid off at time 2 *before* the claims that were reorganized at time 1 are redeemed anything. The irrelevancy of who finances the new purchases of input goods at time 1 results from the fact that X^r_G and its distribution at time 2 among external financiers that reorganized their impaired claims are unaffected by the identity of the financier who finances these purchases necessary to make a reorganization possible.
[14] If investment timing is important (e.g., because of first mover advantages) and/or financial distress is costly then the value of the firm's sales in the good state at time 2 will be smaller than the value of the sales the firm would have realized in the good state at time 1.

B. Agents and Information

There are three rational agents in the model: the entrepreneur, the bank and the supplier. The bank and the supplier are *risk neutral*; they maximize their expected payoff. The entrepreneur is *risk averse* and maximizes her expected utility of wealth. A simple utility function that can serve our purpose is the logarithmic function, whereby the utility of expected wealth is greater than the expected utility of wealth. As the entrepreneur derives no utility – rather than some negative amount of utility, which is conceptually difficult to interpret – from zero wealth, we will use the *logarithm of (1 + wealth)* as the entrepreneur's utility function.

There are two types of entrepreneurs in the population: high quality and low quality ones. Entrepreneurs have private information about their own quality. A fraction α of the population of entrepreneurs is of high quality while a fraction $(1 - \alpha)$ is of low quality. Conditional on being a high quality entrepreneur, there is a probability of π_H that the good state of nature will realize at time 1. Conditional on being a low quality entrepreneur, there is a probability of π_L that the good state of nature will realize at time 1.

At time 0, the entrepreneur knows her own quality while external financiers only know that a fraction α of the population of entrepreneurs is of high quality, and a fraction $(1 - \alpha)$ is of low quality. Therefore, both the bank's and the supplier's ex ante estimate of the probability that X_G will be realized at time 1 equals $\theta = \alpha\pi_H + (1-\alpha)\pi_L$. In traditional industrial sectors, this common prior assumption is likely to hold (e.g., Allen and Gale (1999)); here, it is used to demonstrate that our results are not driven by the lenders' differential information gathering abilities. All agents know at time 0 that if X_B is realized at time 1 and the firm is allowed to reorganize following default, there is a probability of δ $(1 - \delta)$ that X^r_G (X^r_B) will be available for distribution at time 2.[15] Hence, all information asymmetries between the entrepreneur and the external financiers have been resolved by time 1.

[15] One can think of our modeling of the venture as a period during which entrepreneurs learn how to manage a firm. Entrepreneurs of high intrinsic quality have a good chance of ending up in the good state of nature at time 1 while

C. Credit Rates

The riskless interest rate is zero, which means that there is no compensation for time value (normalization). Due to high competitive pressure in the bank loan market (e.g., Amel and Liang (1992), Remolona and Wulfekuhler (1992), Benink and Llewellyn (1994)), banks do not earn (high) rents on their lending activities. In our model, bank rents are normalized to zero. Trade credit is offered by suppliers to promote sales (e.g., Chant and Walker (1988)). We assume that suppliers also earn zero expected profits on their lending activities, which allows us to isolate the pricing of trade credit from the pricing of input goods and thus analytically tackle the model. The bank and the supplier charge an interest rate R^b and R^t, respectively, that compensates them only for credit risk. The credit risk that each lender faces will depend upon the manner in which the entrepreneur chooses to allocate the realized cash flow X_B at time 1 between the creditors and, hence, may be different for banks compared to suppliers.[16] In addition, the credit risk of a bank loan is not necessarily related to the bank's perception of the firm's business risk (θ). For instance, if the amount required to pay off the bank loan at time 1 does not exceed X_B, and the bank anticipates that it is in the entrepreneur's best interest to first pay off the bank loan, then the bank faces no credit risk, *independent* of θ.

We assume that while the trade credit market is competitive, the input market of the entrepreneur (i.e., the output market of the supplier) is not. In other words, the supplier is able to earn rents on the sale of his products, from which he derives his implicit equity stake. For simplicity, the supplier is presumed to be a monopolist, who therefore sets the product price that is charged under immediate payment (i.e., no trade credit used) such that marginal revenue equals

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entrepreneurs of low intrinsic quality are more likely to default. However, independent of their ex ante intrinsic quality (π_i), entrepreneurs who default at time 1 have *learned* somehow to manage a firm so that with probability δ, the entrepreneurial firm will be able to reach the good state by time 2. In our model, the probability that the good state of nature will realize at time 2 following default and reorganization at time 1 (i.e., δ) does not depend on the probability that the good state of nature will realize at time 1 (i.e., π_i). Though, we could elaborate the model to take into account that these two probabilities are interrelated across entrepreneurs. However, this would only complicate the notation of the model without affecting its basic results.

[16] Note that the allocation of the cash flow X_G realized in the good state of nature at time 1 between the creditors is not relevant since all creditors can be fully paid off in that state.

marginal cost. The price that is charged under delayed payment (i.e., when trade credit is used) is determined simultaneously and set such that expected marginal revenue equals marginal cost.[17] In this manner, the supplier is indifferent between customers who pay immediately and customers who use trade credit. Both prices are specified in the contract and the supplier leaves the choice between immediate and delayed payment up to his customers. The difference between the price for immediate and delayed payment determines the price of trade credit (R^t), and corresponds to zero expected profits in the trade credit market. As it is legally forbidden to adjust trade credit terms to individual firms, which would circumvent the regulation on price discrimination,[18] the supplier sets an *average* price for trade credit such that no profits are earned on vendor financing. This means that there is only one price for trade credit in our model. To set this average price, the supplier needs to anticipate which firms will make use of trade credit and to what extent in order to break even in the trade credit market.

D. Liquidation versus Reorganization

Following the realization of the bad state of nature at time 1, external financiers on whose claims the entrepreneurial firm defaulted, have to decide whether or not they will reorganize their impaired claims. Before we consider the forces that drive the reorganization/liquidation decision of external financiers, we discuss under what conditions the entrepreneur will prefer reorganization to liquidation. If creditors decide to liquidate the firm following default, the entrepreneur will receive nothing since L is insufficient to fully cover the defaulted claims.[19]

On the other hand, if external financiers decide to reorganize their defaulted claims, the entrepreneur will derive some private benefits from being able to continue her firm (control rents).

[17] As the supplier is a monopolist, the strategy to centralize demand every period and to produce only on order, such that his marginal cost differs from zero, is dominant.
[18] See art. 81 and 82 of the European Treaty (1997 version) for competition crossing state boundaries of member states of the European Community, which has also been adopted in Belgian legislation for national competition. In the U.S., the Robinson-Patman Act (1936) legally forbids price discrimination.
[19] This corresponds to assuming that $X_B + L < 1$, i.e., the total amount of funds that can be (and is) distributed at time 1 among the external financiers following default and liquidation (i.e., the cash flow from operational activities X_B and the liquidation proceeds L) is insufficient to fully pay off all debtholders.

In the literature (e.g., Aghion and Bolton (1992), Hamilton (2000)), control rents have been defined as the various non-pecuniary aspects related to entrepreneurship; they could for instance result from the utility that the entrepreneur derives from managing her own firm. In our model, the value of entrepreneurial control rents at time 2 is $c^r{}_G$ in the good state and $c^r{}_B$ in the bad state.[20] As the utility that an entrepreneur derives from running a firm presumably is increasing in that firm's performance, we assume that $c^r{}_G > c^r{}_B$, the latter being normalized to zero.[21] The presence of control rents implies the following about the entrepreneur's preference for reorganization to liquidation following the realization of the bad state of nature: if she does not have to bring in additional equity at time 1 to make a reorganization possible – because at start-up, debt was structured such that creditors with impaired claims will decide to reorganize – she will prefer reorganization to liquidation as long as there are positive control rents. On the other hand, if she has to bring in additional equity at time 1 to ward off liquidation – because at start-up, debt was structured such that creditors with impaired claims will decide to liquidate without the additional equity – she will decide whether or not she will contribute new equity on the basis of a comparison between the value that she attributes to control and the value of the personal wealth that she needs to bring in (given that she is rational).

The entrepreneur has some discretion at time 1 in allocating X_B between the bank's and the supplier's claims. In this manner, the entrepreneur may be able to decide which creditor(s) will be involved in the reorganization/liquidation decision once the bad state of nature realizes.[22] This might prove valuable if different lenders adopt different liquidation policies for firms that default.

The bank will base its reorganization/liquidation decision following default against its claims on a comparison of the firm's liquidation value L and going concern value $\delta X^r{}_G$, given that it

[20] The fact that we do not discuss control rents at the other nodes in the tree does not imply that they are assumed to be zero; it only implies that their value does not affect the results of our model.
[21] Our results would continue to hold even if we assumed that $c^r{}_G = c^r{}_B$.
[22] This assumption is not in conflict with priority issues, which arise only in the context of paying out liquidation proceeds (L). Also, even if suppliers have a legal privilege on the goods they delivered, they have no privilege on the cash flows realized from the sale of these – regardless whether they are processed – goods.

has no implicit equity stake in the firm[23] Reputation and liability considerations might reinforce this decision rule. If $\delta X^r_G < L$, the bank will decide upon liquidation while if $\delta X^r_G \geq L$, the bank will prefer reorganization. The supplier, on the other hand, considers not only L and δX^r_G, but also takes into account the additional rents that may be earned on the supply of new input goods if the firm is allowed to reorganize following default. The present value of future profits that can be realized from continued business with the firm represents his implicit equity stake in the firm. If, following reorganization, the good state of nature realizes at time 2, this implicit equity stake is m^r_G, while the value of his stake in the bad state is m^r_B. Since the profits that the supplier reaps from continued business with the firm presumably are increasing in that firm's performance, we assume that $m^r_G > m^r_B$, the latter being normalized to zero.[24] If the bank decides to liquidate the debtor rather than to reorganize following default against its claims, the supplier cannot prevent this from happening: in our model, no side payments are possible between external financiers and the supplier cannot take over the bank's claims at time 1 following the realization of the bad state of nature. This assumption again might result from reputation and liability considerations on the part of the bank.

When the creditors of the defaulted claims allow the firm to reorganize, they effectively agree to *postpone* their impaired claims to make a reorganization possible. The interest rate that is set on these reorganized claims should compensate lenders for the credit risk prevailing at the time of reorganization (R^{rb} for reorganized bank claims and R^{rt} for reorganized supplier claims).[25]

Below, we summarize the basic structure of the model and the notation used:

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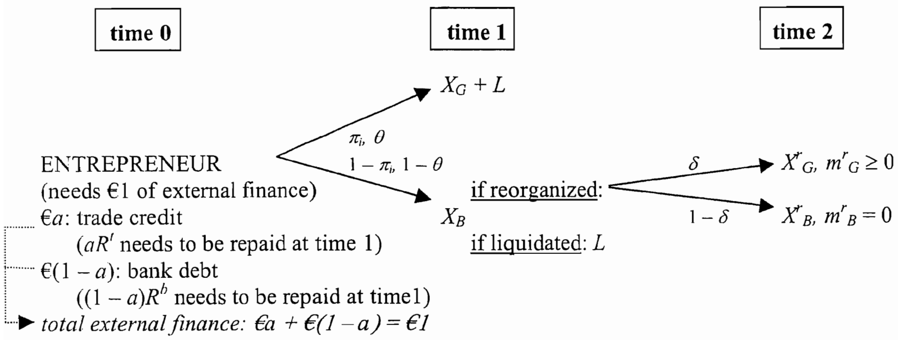
[23] The going concern value calculated by the bank ignores the entrepreneur's control rents. From the point of view of the entrepreneur, liquidation will therefore be considered as excessive.

[24] Our results would continue to hold even if we assumed that $m^r_G = m^r_B$.

[25] The (gross) interest rate on reorganized claims will be set as follows. Creditors who reorganize their impaired claims anticipate that with probability δ, the good state of nature will realize by time 2 and then a cash flow of X^r_G will be available for distribution among them, whereas with probability $(1 - \delta)$, the bad state of nature will realize and then there will be no cash left to (partly) redeem them. The only interest rate that is compatible with this payoff pattern at time 2 and zero rents in both credit markets is: $R^{rb} = R^{rt} = 1/\delta$. Note that if at time 2, X^r_G is not sufficiently high to (fully) pay off all lenders who reorganized their claims, then lenders will not be able to break even following reorganization. but this might induce them to liquidate rather than to reorganize following default at time 1.



where:

- X: cash flow realized from operational activities, which can be distributed among the external financiers that lent money at start-up
  - X_G: cash flow available for distribution at time 1 in the good state of nature
  - X_B: cash flow available for distribution at time 1 in the bad state of nature
  - X^r_G: cash flow available for distribution at time 2 in the good state of nature after the firm has been reorganized following the realization of X_B at time 1
  - X^r_B: cash flow available for distribution at time 2 in the bad state of nature after the firm has been reorganized following the realization of X_B at time 1; $X^r_B = 0$
- L: liquidation value of the firm's assets at time 1[26]
- a: fraction of total external finance that is trade credit; $0 \leq a \leq 1$
- R^t: price of trade credit (gross interest rate = 1 + interest rate) set at time 0
- $(1-a)$: fraction of total external finance that is bank debt
- R^b: price of bank debt (gross interest rate) set at time 0
- π: a stochastic variable that captures the probability that the good state of nature will realize at time 1, and which can take only one of two values: $\pi = \pi_H$ for high quality entrepreneurs and $\pi = \pi_L$ for low quality entrepreneurs (with $0 < \pi_i < 1$)
- α: fraction of the population of entrepreneurs who are of high quality
- θ: the probability that the good state of nature will realize at time 1 as perceived/estimated by external financiers at start-up
  - If the equilibrium that is modeled is *pooling* then: $\theta = \alpha\pi_H + (1-\alpha)\pi_L$
  - If the equilibrium that is modeled is *separating* then: $\theta = \pi_H$ if the perceived entrepreneurial quality is high and $\theta = \pi_L$ if the perceived entrepreneurial quality is low
- δ: the probability that the good state of nature will realize at time 2 following default and reorganization at time 1
- m^r_G: the implicit equity stake of the supplier if the good state of nature realizes at time 2
- m^r_B: the implicit equity stake of the supplier if the bad state of nature realizes at time 2; $m^r_B = 0$
- c^r_G: the value of the entrepreneur's control rents if the good state of nature realizes at time 2
- c^r_B: the value of the entrepreneur's control rents if the bad state of nature realizes at time 2; $c^r_B = 0$

[26] Note that as the cash flow X_G (or X_B) is always fully paid out at time 1 to external financiers and/or the entrepreneur, L cannot contain any operating results realized since start-up (e.g., a higher cash position resulting from retained earnings).

III. Demand of a Strictly Constrained Entrepreneur

In this section, we consider a *strictly constrained* entrepreneur, i.e. an entrepreneur who has brought in all her personal wealth as equity at the time of start-up in order to meet the minimum equity contribution for limited liability firms. The financial structure decision then is reduced to a decision on structuring external funds (i.e., the proportion of external finance that is bank debt versus trade credit). Following the realization of the bad state of nature at time 1, such a strictly constrained entrepreneur cannot bring in additional equity in order to facilitate a reorganization of the defaulted claims. Therefore, when structuring external finance at start-up, the entrepreneur might be concerned about the liquidation policy that creditors will adopt following default. We start our discussion by considering the case where X_B has been realized and the firm's liquidation value exceeds its going concern value, i.e., $L > \delta X^r_G$. The reverse case is discussed thereafter.

Case 1: The Liquidation Value Exceeds the Going Concern Value

If the firm's liquidation value exceeds its going concern value, the bank will decide to liquidate if involved in the reorganization/liquidation decision. If the bank is fully paid off following the realization of X_B at time 1, it will not be involved in that decision. Therefore, if at start-up, the bank anticipates that, independent of the state that realizes, it will always be fully paid off at time 1, it will charge the risk free rate, independent of the firm's perceived credit quality θ. Then, following the realization of the bad state of nature at time 1, default will only occur against the supplier, who will decide in favor of reorganization if his implicit equity stake is large enough. As the interest of our model lies here, we assume that the supplier's implicit equity stake indeed satisfies a certain boundary condition, which is derived in the following paragraph. On the other hand, if the bank is not fully paid off following the realization of X_B at time 1, it will decide to liquidate the firm. Since the entrepreneur is strictly constrained, she cannot prevent liquidation. Neither can the supplier prevent the liquidation since no side payments between the bank and the supplier are allowed in our model. Therefore, depending on their perceived quality π_i, entrepreneurs with large benefits from control may have an incentive to structure their debt financing such that the defaulted claims will be reorganized following default. As a result, they will choose a combination of bank debt and trade credit such that default against the bank can always be circumvented and such that interest expenses are minimized. Entrepreneurs who only consider the prices of the different types of credit, on the other hand, will borrow exclusively from the bank at start-up to minimize their financing costs. These insights are formally derived below.

We first derive the boundary condition for the risk neutral supplier's implicit equity stake such that the firm's defaulted claims will be reorganized in the bad state of nature at time 1 given that the firm has first paid off the bank loan from the available cash flow X_B. If the supplier decides to liquidate, his total payoff equals:

$$\underbrace{\left[X_B-(1-a)R^b\right]}_{\substack{\text{cash flow already received}\\ \text{by the supplier at time 1}}}+\min\left\{\underbrace{aR^t-\left[X_B-(1-a)R^b\right]}_{\substack{\text{remaining claim of}\\ \text{the supplier}}},L\right\}=\left[X_B-(1-a)R^b\right]+L \tag{1}$$

(since $X_B + L < I$ and $(1-a)R^b + aR^t \geq I$)

If the supplier agrees to reorganize his claim, a new interest rate R^{rt} will be set for the *reorganized debt* so that the supplier is compensated for the new prevailing credit risk, i.e. such that the expected payoff, which is $\delta\min\left\{\left[aR^t-(X_B-(1-a)R^b)\right]R^{rt},X^r{}_G\right\}+(1-\delta)0$, is equal to the claim that is still outstanding $\left[aR^t-(X_B-(1-a)R^b)\right]$. This results in $R^{rt}=1/\delta$. The supplier's total expected payoff under reorganization then equals:

$$\underbrace{\left[X_B-(1-a)R^b\right]}_{\substack{\text{cash flow already received}\\ \text{by the supplier at time 1}}}+\delta\left[\underbrace{m^r{}_G}_{\substack{\text{implicit}\\ \text{equity stake}}}+\min\left\{\underbrace{\frac{aR^t-\left[X_B-(1-a)R^b\right]}{\delta}}_{\text{reorganized trade credit claim}},X^r{}_G\right\}\right]$$

(since $X_B - L < I$, $\delta X^r{}_G < L$ and $(1-a)R^b + aR^t \geq I$)

$$=\left[X_B-(1-a)R^b\right]+\delta m^r{}_G+\delta X^r{}_G \tag{2}$$

The supplier will therefore prefer reorganization to liquidation if:[27]

[27] By comparing his total payoff under liquidation to his total expected payoff under reorganization, the supplier effectively bases his decision on cash flows that are *marginal* to the decision.

$$\left[X_B - (1-a)R^b\right] + \delta m^r{}_G + \delta X^r{}_G > \left[X_B - (1-a)R^b\right] + L$$

which is equivalent to

$$\delta m^r{}_G + \delta X^r{}_G > L \qquad or \qquad m^r{}_G > (L - \delta X^r{}_G)/\delta \tag{3}$$

In the remainder of the paper, we assume that the above boundary condition is fulfilled, i.e. that the implicit equity stake of the supplier is sufficiently large so that the supplier will prefer reorganization to liquidation following default against his claims.

The risk averse entrepreneur will choose the debt structure that maximizes her expected utility from investing in the project, which can be written as:[28]

$$\begin{aligned}
&\pi_i * \ln\left\{1 + \left[X_G + L - (aR^t + (1-a)R^b)\right]\right\} \\
&\quad + (1-\pi_i)\gamma * \ln\left\{1 + \left[\max\left\{X_B + L - (aR^t + (1-a)R^b), 0\right\}\right]\right\} \\
&\quad + (1-\pi_i)(1-\gamma)\delta * \ln\left\{1 + \left[\max\left\{X^r{}_G - \frac{\left[aR^t - (X_B - (1-a)R^b)\right]}{\delta}, 0\right\} + c^r{}_G\right]\right\} \\
&\quad + (1-\pi_i)(1-\gamma)(1-\delta) * \ln\left\{1 + [0]\right\}
\end{aligned}$$

which can be simplified to: i = H, L

$$\pi_i * \ln\left\{1 + \left[X_G + L - (aR^t + (1-a)R^b)\right]\right\} + (1-\pi_i)(1-\gamma)\delta * \ln\left\{1 + \left[c^r{}_G\right]\right\} \tag{4}$$

where $\gamma = 1$ if the bank is involved in the reorganization/liquidation decision, resulting in the liquidation of the firm. If the bank is not involved in the reorganization/liquidation decision, $\gamma = 0$. In the latter case, the supplier, who has a remaining claim of $\left[aR^t - (X_B - (1-a)R^b)\right]$, will choose to reorganize following default as his implicit equity stake satisfies boundary condition (3) by assumption and charge an (gross) interest rate of $1/\delta$ on his reorganized claim.

Equation (4) shows that the debt structure that maximizes the entrepreneur's expected utility depends upon her intrinsic quality π_i, which is unobservable by the creditors. The game that we model, is a static game of complete information. Therefore, the equilibrium solution of the model is a Nash equilibrium. If the equilibrium is separating, then high quality entrepreneurs will borrow exclusively from the bank ($a = 0$) to minimize their cost of external finance while low quality

[28] Note that the entrepreneur's expected utility does not depend on the priority structure of debt. Therefore, priority issues do not affect our analysis.

entrepreneurs will contract only partial bank finance ($a > 0$). In the latter case, the fraction of debt financing that is trade credit will be set at $a = (1 - X_B)$, which allows low quality entrepreneurs to avoid a potential default against the bank and to minimize their financing cost.[29, 30]

As a result, the creditors can infer the quality type from the chosen debt structure. If an entrepreneur contracts no trade credit ($a = 0$) then, in a separating equilibrium, the bank will infer $\pi = \pi_H$ and charge the corresponding bank rate R^{bH}. For an entrepreneur who contracts only partial

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[29] Given the equilibrium price of bank debt, the proportion of external finance demanded as bank debt, $(1 - a)$, will be set such that $(1 - a)R^b = X_B$. This strategy makes maximum use of cheaper bank debt while preventing the bank from being involved in the reorganization/liquidation decision: in the bad state at time 1, X_B is first used to pay off the bank loan and $\gamma = 0$. Given that the bank faces no credit risk and that the bank credit market is competitive, the bank will set $R^b = 1$ and, thus, the entrepreneur will choose $a = (1 - X_B)$.

[30] Given that the entrepreneur decides to contract an amount of trade credit finance such that the bank is not involved in the reorganization/liquidation decision following the realization of X_B at time 1, it seems that she would be *indifferent* between maximum trade credit finance possible ($a = 1$) and minimum trade credit finance possible ($a = (1 - X_B)$) – or some intermediate amount of trade credit finance (i.e., $a \in]1 - X_B, 1[$) – in order to still have $\gamma = 0$:

full trade credit finance (i.e., $a = 1$): *versus* *partial (minimum) trade credit finance (i.e., $a = (1 - X_B)$)*

Full trade credit finance:

The bank, respectively the supplier, will set its price for credit to achieve zero expected rents:

- bank: no bank debt is contracted
- supplier: the expected payoff from the loan, $\theta R^{t,full} + (1 - \theta)(X_B + \delta X^r_G)$, should equal the amount initially invested, €1

$$\Rightarrow R^{t,full} = 1/\theta - \frac{(1-\theta)(X_B + \delta X^r_G)}{\theta}$$

where $\theta = \alpha\pi_H + (1 - \alpha)\pi_L$ if the equilibrium is *pooling* or $\theta = \pi_L$ if the equilibrium is *separating*

total cost of external finance:

$$= €1 * R^{t,full}$$

$$= 1/\theta - \frac{(1-\theta)(X_B + \delta X^r_G)}{\theta}$$

Partial (minimum) trade credit finance:

The bank, respectively the supplier, will set its price for credit to achieve zero expected rents:

- bank: the expected payoff from the loan, $\theta X_B R^{b,partial} + (1 - \theta)X_B R^{b,partial}$, should equal the amount initially invested, €X_B

$$\Rightarrow R^{b,partial} = 1$$

- supplier: the expected payoff from the loan, $\theta(1 - X_B)R^{t,partial} + (1 - \theta)\delta X^r_G$, should equal the amount initially invested, €$(1 - X_B)$

$$\Rightarrow R^{t,partial} = 1/\theta - \frac{(1-\theta)\delta X^r_G}{\theta(1 - X_B)}$$

where $\theta = \alpha\pi_H + (1 - \alpha)\pi_L$ if the equilibrium is *pooling* or $\theta = \pi_L$ if the equilibrium is *separating*

total cost of external finance:

$$= €X_B * R^{b,partial} + €(1 - X_B) * R^{t,partial}$$

$$= X_B * 1 + (1 - X_B) * [1/\theta - \frac{(1-\theta)\delta X^r_G}{\theta(1 - X_B)}]$$

$$= 1/\theta - \frac{(1-\theta)(X_B + \delta X^r_G)}{\theta}$$

However, the supplier can set only *one* price for trade credit finance. The eventual price that the supplier sets will equalize his expected marginal revenue to his marginal cost. Therefore, the price of trade credit will be a "weighted average" of the different prices $1/\theta - \frac{(1-\theta)[(X_B - (1-a)) + \delta X^r_G]}{\theta a}$, each corresponding to an $a \in [1 - X_B, 1]$, where each price is set to make the supplier earning zero rents on his lending activities, given that a particular a has been chosen. The weights used will be determined by the likelihood that each a from the interval $[1 - X_B, 1]$ will be chosen. However, a supplier that would set this average price would disproportionately attract entrepreneurs who choose to set $a = (1 - X_B)$ (with $R^b = 1$), and who would only have to pay the "average" trade credit price rather than the higher trade credit price $1/\theta - \frac{(1-\theta)\delta X^r_G}{\theta(1 - X_B)}$. Note that the process that we describe here is another example of *adverse selection*.

Hence, the only price of trade credit that is sustainable with equilibrium is $1/\theta - \frac{(1-\theta)\delta X^r_G}{\theta(1 - X_B)}$. Then, for bank finance ($a > 0$), both creditors will infer $\pi = \pi_L$ and charge the corresponding bank rate R^{bL} and supplier rate R^{tL}. In Appendix 1, we derive the value of the separating quality level π^*. If π_L lies in the interval $[0, \pi^*[$ and π_H lies in the interval $]\pi^*, 1]$, where

$$\pi^* = \frac{\ln\left\{1 + c'_G\right\}^{\delta}}{\ln\left\{1 + X_G + L - R^{bH}\right\} - \ln\left\{1 + X_G + L - X_B - (1 - X_B)R^{tL}\right\} + \ln\left\{1 + c'_G\right\}^{\delta}},$$

$$R^{bH} = 1/\pi_H - \frac{(1-\pi_H)(X_B + L)}{\pi_H},$$

$$R^{bL} = 1, \text{ and } R^{tL} = 1/\pi_L - \frac{(1-\pi_L)\delta X'_G}{\pi_L(1 - X_B)},$$

it is optimal for the low quality entrepreneur to contract partial bank finance ($a > 0$) with the amount of bank debt equal to X_B and the amount of trade credit equal to $(1 - X_B)$, while for the high quality entrepreneur, it is optimal to borrow exclusively from the bank ($a = 0$).

The results from Appendix 1 can be interpreted as follows. Since bank debt is cheaper than trade credit,[31] a high quality entrepreneur will prefer to borrow exclusively from the bank if the lower interest expenses under the good state of nature at time 1 more than offset the loss of control rents under the bad state of nature at time 1. Entrepreneurs will put more weight on the minimization of financing expenses as the likelihood that the good state of nature will realize at time 1 increases, ceteris paribus. For a low quality entrepreneur, however, the stricter enforcement of liquidation rights by the bank may dominate the lower price of bank debt. When the value of control rents (c'_G) is large, the loss of these control rents following default at time 1 when borrowing exclusively from the bank is no longer compensated by the lower interest rate R^b.

In Appendix 2, we compute the first order derivatives of π^* with respect to each of the parameters of the model. Our main results are the following: (1) $\partial\pi^*/\partial R^{bH} > 0$ and $\partial\pi^*/\partial R^{tL} < 0$,

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entrepreneurs who prefer to avoid the bank from being involved in the reorganization/liquidation decision, it is optimal to choose $a = (1 - X_B)$.

[31] Initially, bank debt is cheaper because the bank will liquidate the firm following the realization of X_B if not fully paid off. Then, L is the cash flow from the reorganization/liquidation decision. On the other hand, if the bank is fully paid off, the supplier will, given his implicit equity stake, allow the firm to reorganize. Then, $\delta X'_G$ is the expected cash flow from the reorganization/liquidation decision. Since $\delta X'_G < L$ and both credit markets are competitive, borrowing exclusively from the bank will entail lower financing expenses than borrowing exclusively from the supplier. If the resulting equilibrium is separating, borrowing exclusively from the bank will even become cheaper as then banks know that only high quality entrepreneurs will prefer to borrow exclusively from the bank.

which implies that when the price of bank debt falls (or the price of trade credit increases), the separating π^* falls as the advantage of the supplier's lenient liquidation policy has become smaller. An increase in the cash flow X^r_G only reduces the price of trade credit and, therefore, reduces the drawback associated with partial bank and trade credit financing, i.e., $\partial\pi^*/\partial X^r_G > 0$. (2) $\partial\pi^*/\partial c^r_G > 0$ and $\partial\pi^*/\partial\delta > 0$, which implies that higher control rents raise the value of being allowed to reorganize following default. Hence, the separating π^* increases, ceteris paribus. (3) $\partial\pi^*/\partial X_G > 0$, which at first may seem counterintuitive since it could be argued that higher cash flows in the good state increase the weight that entrepreneurs put on this state. However, because of risk aversion, lower financing expenses in the good state when borrowing exclusively from the bank may no longer weigh against the loss of control rents in the bad state. (3) $\partial\pi^*/\partial X_B > 0$, which again can be explained by the reduced price of external financing and entrepreneurial risk aversion.

We have a pooling equilibrium if both π_H and π_L are located in the same interval. If π_H and $\pi_L \in [0, \pi^*[$, the equilibrium will be pooling at partial bank finance ($a > 0$) with the amount of bank debt equal to X_B and the amount of trade credit equal to $(1 - X_B)$. The bank and the supplier charge the following prices for credit:

$$R^{h\theta} = 1 \text{, and}$$

$$R^{t\theta} = 1/\theta - \frac{(1-\theta)\delta X^r{}_G}{\theta},$$

with $\theta = \alpha\pi_H + (1 - \alpha)\pi_L$ and α = the proportion of high quality entrepreneurs.

If π_H and $\pi_L \in]\pi^*, 1]$, the equilibrium will be pooling at full bank finance ($a = 0$), and the bank charges the following price for credit:

$$R^{h\theta} = 1/\theta - \frac{(1-\theta)(X_B + L)}{\theta}.$$

In the above described pooling equilibria, high quality entrepreneurs may resort to signaling to reveal their higher quality to the bank. If the equilibrium is pooling at full bank finance, signaling cannot occur through the amount of equity brought in at start-up, given that entrepreneurs are strictly constrained. Other mechanisms, which have been discussed extensively in the literature (e.g., collateral in Bester (1987), the percentage of equity retained in Leland and Pyle (1977), etc.) might play an important role, but these are beyond the scope of our paper. Therefore, in our model, when the equilibrium is pooling at full bank finance, there is no way for high quality strictly constrained entrepreneurs to reveal their higher quality. Next, if the equilibrium is pooling at partial bank finance, high quality strictly constrained entrepreneurs have no incentive to signal their higher quality: the bank already charges the lowest possible rate ($R^{b\theta} = 1$), and suppliers are prohibited by law from practicing price discrimination on their trade credit.

Case 2: the Going Concern Value Exceeds the Liquidation Value

If the firm's going concern value exceeds its liquidation value ($\delta X^{r}_{G} \geq L$), entrepreneurs are indifferent between bank debt and trade credit: both the bank and the supplier will decide to reorganize following the realization of the bad state of nature at time 1 and, thus, the fraction of external finance that is bank debt cannot be used to signal quality. Also, since entrepreneurs have limited personal wealth, they cannot use their equity contribution at start-up to signal their quality. Then, the price of bank debt and trade credit will be identical and the equilibrium will be pooling. This case is discussed in detail in Appendix 3.

IV. Demand of a Weakly Constrained Entrepreneur

In this section, we consider a *weakly constrained* entrepreneur, i.e. an entrepreneur whose personal wealth exceeds the minimum equity contribution for limited liability firms, but is insufficient to finance all input goods. In addition to setting the fraction of bank debt versus trade credit, this entrepreneur must also decide how much equity to contribute beyond the legal minimum. The amount of external finance that must be contracted at start-up then is equal to € *(1 – additional equity contributed beyond the legal minimum)*. A weakly constrained entrepreneur who anticipates that she can bring in additional equity in the bad state of nature at time 1 in order to facilitate a reorganization, might decide to contract more bank debt (than X_B) at start-up in order to lower financing expenses while maintaining the advantage that her firm will not be liquidated once the bad state of nature realizes. Again, we start our discussion by considering the case where X_B has been realized and the firm's liquidation value exceeds its going concern value, i.e., $L \geq X^{r}_{G}$.

Case 1: The Liquidation Value Exceeds the Going Concern Value

To demonstrate the special role of the supplier's implicit equity stake, we continue to assume that the boundary condition (3) is satisfied, i.e., $m^{r}_{G} > (L - \delta X^{r}_{G})/\delta$. Therefore, whether the firm will be reorganized or liquidated given that its liquidation value exceeds its going concern value, depends on whether the bank is involved in that decision.

A weakly constrained entrepreneur who contracts an amount of bank debt equal to $X_B + w > X_B$ at start-up might be able to ward off liquidation at time 1 by contributing additional equity in the bad state. If the bank anticipates that its claim will always be fully paid off at time 1, it will still charge the risk free rate to the entrepreneur at start-up. Then, the amount of equity that the entrepreneur needs to bring in to prevent liquidation at time 1 equals w, which is exactly the amount of bank debt over and above X_B that the entrepreneur contracted at start-up. Whether or not additional equity will actually be contributed, depends on two factors: (1) whether liquidation can be prevented, and (2) whether control rents are sufficiently large. In the following paragraph, we argue that the upper boundary for the amount of equity w that a weakly constrained entrepreneur can credibly promise – because it is in her self-interest – to contribute in the bad state is:

$$min\{W, \delta c^{r}_{G} - \lambda\},$$

where W is the amount of personal wealth left at start-up if the entrepreneur contributes only the legally required minimum ($W < 1$ by assumption), and λ is the risk premium that makes a risk averse entrepreneur indifferent between a certain value of ($\delta c^{r}_{G} - \lambda$) and an expected value of (δc^{r}_{G} + $(1 - \delta)0$). λ can be calculated as follows:

$$\ln\left\{1+\left[\delta c^{r}{}_{G}-\lambda\right]\right\}=\delta\ln\left\{1+c^{r}{}_{G}\right\}+(1-\delta)\ln\left\{1\right\}$$

$$or\ \lambda = 1+\delta c^{r}{}_{G}-(1+c^{r}{}_{G})^{\delta}$$

Our result that w will not be set at a value greater than $min\{W,\ \delta c^{r}{}_{G}-\lambda\}$ follows from the fact that the entrepreneur will only contribute additional equity in the bad state at time 1 if the utility derived from preserving control rents is larger than the utility derived from the amount of personal wealth that she must give up. If $W > \delta c^{r}{}_{G} - \lambda$, then the upper boundary for w is $(\delta c^{r}{}_{G} - \lambda)$ because if the entrepreneur would set a greater w' then, in the bad state, she would need to give up w' to prevent liquidation while she would receive only $\delta c^{r}{}_{G}$ in expected value, the latter being equivalent to a certain $(\delta c^{r}{}_{G} - \lambda)$. Therefore, once the bad state realizes, she would never give up w' and her firm would be liquidated. On the other hand, if $W < \delta c^{r}{}_{G} - \lambda$, then the upper boundary for w is W because if the entrepreneur would set a greater w'' then, in the bad state, she would only be able to bring in W. However, she would never give up W to receive nothing in return as she would not be able to prevent liquidation by bringing in all her remaining wealth W.

In Appendix 4, we show that if creditors anticipate that an entrepreneur who contracted $(X_B + w)$ of bank debt will not bring in w in the bad state – because $w > min\{W,\ \delta c^{r}{}_{G} - \lambda\}$ – it is in the entrepreneur's best interest to contract only X_B rather than $(X_B + w)$ of bank debt. This results from the fact that external financiers will not lower their price of credit, as the entrepreneur is not giving a credible quality signal, and following default, the firm will be liquidated. On the other hand, by contracting $(X_B + w)$ of bank debt at start-up with $w \le min\{W,\ \delta c^{r}{}_{G} - \lambda\}$, there is no doubt that the entrepreneur can and will contribute w in the bad state and the firm will be reorganized.

In the discussion that follows, we distinguish two situations, depending on whether or not an entrepreneur who borrows exclusively from the bank at start-up will ward off liquidation by contributing new equity once the bad state realizes. We first consider the case where $min\{W,\ \delta c^{r}{}_{G} - \lambda\} < (1 - X_B)$, and thus her firm will be liquidated in the bad state. This will be the case for entrepreneurs with limited personal wealth. Next, we consider the case where $min\{W,\ \delta c^{r}{}_{G} - \lambda\} \ge$

$(1 - X_B)$. In this last case, even an entrepreneur who borrows exclusively from the bank is able to – and will – ward off liquidation in the bad state.

Case 1.a. min{W, $\delta c^r{}_G - \lambda$} < 1 – X_B

We start by assuming that weakly constrained entrepreneurs only bring in the minimum equity contribution required by law. Below, we show that both high and low quality entrepreneurs will not deviate from this assumption, given that the equilibrium is separating. On the other hand, if the equilibrium is pooling, a high quality weakly constrained entrepreneur might use her equity contribution to force the equilibrium to become separating.

If a weakly constrained entrepreneur borrows exclusively from the bank ($a = 0$), then, following default, she needs to bring in $(1 - X_B)$, which she either is not able to bring in (e.g., if $W < 1 - X_B < \delta c^r{}_G - \lambda$) or chooses to forego (e.g., if $W > 1 - X_B > \delta c^r{}_G - \lambda$). As a consequence, this entrepreneur will never bring in some additional equity in the bad state at time 1. Rational banks will set the price of bank debt accordingly: given that the entrepreneur only brings in minimum equity at start-up, R^b will be set at $1/\theta - \frac{(1-\theta)(X_B + L)}{\theta}$.[32]

If a weakly constrained entrepreneur contracts partial bank finance ($a > 0$) with the amount of bank debt equal to $(X_B + w)$, the amount of trade credit equal to $(1 - X_B - w)$ and $w \leq min\{W, \delta c^r{}_G - \lambda\}$, she knows that she can and will ward off liquidation by the bank in the bad state of nature by bringing in an amount w as new equity: she knows that the supplier will prefer reorganization and that side payments from the supplier to the bank cannot occur. Contracting more bank debt than X_B allows her to finance a larger fraction of debt at the lower bank rate $R^b = 1$. When $min\{W, \delta c^r{}_G - \lambda\} < (1 - X_B)$, we find that the separating equilibrium of the previous section, where high quality entrepreneurs borrow exclusively from the bank ($a = 0$) and low quality

[32] where $\theta = \alpha\pi_H + (1 - \alpha)\pi_L$ if the equilibrium is pooling at full bank finance and $\theta = \pi_H$ if the equilibrium is separating with high (low) quality entrepreneurs contracting full (partial) bank finance. For the equilibrium to be

entrepreneurs contract partial bank finance ($a > 0$), is preserved when the entrepreneur is no longer strictly constrained. When π_L lies in the interval $[0, \pi^*[$ and π_H lies in the interval $]\pi^*, 1]$, where

$$\pi^* = \frac{\ln\{1 + c^r{}_G + W\}^\delta - \ln\{1 + W\}^\delta}{\begin{bmatrix} \ln\{1 + X_G + L - R^{bH} + W\} + \ln\{1 + c^r{}_G + W\}^\delta \\ - \ln\{1 + X_G + L - X_B - (1 - X_B)R^{tL} + W\} - \ln\{1 + W\}^\delta \end{bmatrix}},$$

$$R^{bH} = 1/\pi_H - \frac{(1 - \pi_H)(X_B + L)}{\pi_H},$$

$$R^{bL} = 1, \text{ and } R^{tL} = 1/\pi_L - \frac{(1 - \pi_L)\delta X^r{}_G}{\pi_L(1 - X_B)},$$

it is optimal for the low quality entrepreneur to contract partial bank finance ($a > 0$) with the amount of bank debt equal to X_B and the amount of trade credit equal to $(1 - X_B)$, while for the high quality entrepreneur, it is optimal to borrow exclusively from the bank ($a = 0$). The above derived separating condition on entrepreneurial quality, π^*, is decreasing in W (i.e., $\partial\pi^*/\partial W < 0$), which indicates that wealthier entrepreneurs are more likely to borrow exclusively from the bank at start-up, ceteris paribus. The sign of the other derivatives remains the same as discussed in the previous model (see Appendix 2).

In this separating equilibrium, neither high nor low quality entrepreneurs have an incentive to contribute more equity at start-up than the legal minimum because of risk aversion. In addition, low quality entrepreneurs have no incentive to contract more bank debt than X_B. Proofs of these propositions are given in Appendix 5.

We have a pooling equilibrium if both π_H and π_L are located in the same interval. If both π_H and π_L lie below π^*, the equilibrium is pooling at partial bank finance while if both π_H and π_L lie above π^*, the equilibrium is pooling at full bank finance. In a pooling equilibrium, high quality entrepreneurs may have an incentive to dissociate themselves from low quality ones to lower their interest expenses. Then, two new separating equilibria result, which are discussed subsequently.

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pooling at full bank finance, both π_L and π_H should be in the same interval $]\pi^*, 1]$, where the cutoff value π^* is determined below.

If both π_H and π_L lie *below* the separating condition π^*, then a high quality weakly constrained entrepreneur *might* have an incentive to contract more bank debt at start-up to lower financing expenses. Interest expenses can be lowered by increasing the fraction of external finance that is bank debt since $R^b = 1$ is lower than the trade credit rate R^t. However, the lower financing rate comes at a cost of having to give up w if the bad state of nature realizes. In the resulting separating equilibrium, we find that when π_L lies in the interval $[0, \pi^{*\prime}[$ and π_H lies in the interval $]\pi^{*\prime}, 1]$, where

$$\pi^{*\prime} = \frac{\ln\{1+c^r{}_G+W\}^{\delta} - \ln\{1+c^r{}_G+W-w\}^{\delta} + \ln\{1+W\}^{(1-\delta)} - \ln\{1+W-w\}^{(1-\delta)}}{\left[\begin{array}{l}\ln\{1+X_G+L-X_B-(1-X_B-w)R^{t\theta,new}+W-w\}+\ln\{1+\delta c^r{}_G+W\}+\ln\{1+W\}^{(1-\delta)} \\ -\ln\{1+X_G+L-X_B-(1-X_B)R^{t\theta,new}+W\}-\ln\{1+\delta c^r{}_G+W-w\}-\ln\{1+W-w\}^{(1-\delta)}\end{array}\right]},$$

$$R^{bH} = 1,\ R^{bL} = 1,$$

$$R^{t\theta,new} = \frac{(1-X_B)-\alpha w-(1-\theta)\delta X^r{}_G}{[\theta(1-X_B)-\alpha\pi_H w]}\text{[33]},$$

it is optimal for the low quality entrepreneur to contract partial bank finance ($a > 0$) with the amount of bank debt equal to X_B and the amount of trade credit equal to $(1 - X_B)$, while for the high quality entrepreneur, it is optimal to contract partial bank finance ($a > 0$) with the amount of trade credit equal to $(1 - X_B - w)$. Moreover, high quality entrepreneurs might be indifferent between contracting € $(X_B + w)$ of bank debt and then contributing w once the bad state realizes on the one hand, and contracting € X_B of bank debt and contributing *€ (the legal minimum* $+ w$) in equity at start-up on the other hand.[34]

[33] If there is no doubt that high quality entrepreneurs will bring in w in the bad state, the supplier will revise his price for trade credit $R^{t\theta,new}$ downwards so that no rents are earned in the trade credit market as follows:

$$\underbrace{\alpha(1-X_B-w)+(1-\alpha)(1-X_B)}_{\text{mean amount invested by the supplier}} = \underbrace{\alpha[\pi_H(1-X_B-w)R^{t\theta,new}+(1-\pi_H)\delta X^r{}_G]+(1-\alpha)[\pi_L(1-X_B)R^{t\theta,new}+(1-\pi_L)\delta X^r{}_G]}_{\text{expected payoff for the supplier from providing trade credit}}$$

$$(1-X_B)-\alpha w = [(\alpha\pi_H+(1-\alpha)\pi_L)(1-X_B)-\alpha\pi_H w]R^{t\theta,new}+[\alpha(1-\pi_H)+(1-\alpha)(1-\pi_L)]\delta X^r{}_G$$

$$(1-X_B)-\alpha w = [\theta(1-X_B)-\alpha\pi_H w]R^{t\theta,new}+(1-\theta)\delta X^r{}_G$$

$$R^{t\theta,new} = \frac{(1-X_B)-\alpha w-(1-\theta)\delta X^r{}_G}{[\theta(1-X_B)-\alpha\pi_H w]}$$

[34] In case w is brought in as additional equity at start-up, the condition $w \leq min\{W, \delta c^r{}_G - \lambda\}$ is no longer needed because no additional equity has to be contributed in the bad state at time 1 to ward off liquidation; then, w is only bounded by W, i.e., $w \leq W$. This will prove valuable if the utility attributed to control rents is lower than the utility attributed to remaining personal wealth W; then, $min\{W, \delta c^r{}_G - \lambda\} = (\delta c^r{}_G - \lambda)$. Therefore, if the optimal w, i.e., the

As entrepreneurs are risk averse, the high quality weakly constrained entrepreneur will choose the smallest w that allows dissociation from low quality entrepreneurs. Then, w is set according to the following equality:

$$\begin{aligned}&\pi_H \ln\left\{1+X_G+L-(X_B+w)-(1-X_B-w)R^{t\theta,new}+W\right\}\\&\quad+(1-\pi_H)\delta\ln\left\{1+c^r{}_G+W-w\right\}+(1-\pi_H)(1-\delta)\ln\{1+W-w\}\\&=\pi_H \ln\left\{1+X_G+L-X_B-(1-X_B)R^{t\theta,new}+W\right\}\\&\quad+(1-\pi_H)\delta\ln\left\{1+c^r{}_G+W\right\}+(1-\pi_H)(1-\delta)\ln\{1+W\}\end{aligned}$$

If there is no solution for w that satisfies the constraint $w \le min\{W,\ \delta c^r{}_G - \lambda\}$ (or $w \le W$ – see footnote 34) given that both π_H and π_L lie *below* π^*, the equilibrium can only be pooling at partial bank finance. Then, both low and high quality entrepreneurs set the amount of bank debt equal to X_B, the amount of trade credit equal to $(1 - X_B)$ and no entrepreneur has an incentive to bring in more equity than the legal minimum.

If both π_H and π_L lie *above* the separating condition π^*, then a high quality weakly constrained entrepreneur *might* have an incentive to bring in more equity at start-up and thus demand less external (bank) finance to obtain a lower price for bank debt, which results from signaling here. In the resulting separating equilibrium, we find that that when π_L lies in the interval $[0, \pi^{*\prime\prime}[$ and π_H lies in the interval $]\pi^{*\prime\prime}, 1]$, where

$$\pi^{*\prime\prime}=\frac{\ln\{1+W\}-\ln\{1+W-w\}}{\begin{bmatrix}\ln\left\{1+X_G+L-(1-w)R^{bH}+W-w\right\}+\ln\{1+W\}\\-\ln\left\{1+X_G+L-R^{bL}+W\right\}-\ln\{1+W-w\}\end{bmatrix}},$$

$$R^{bL}=1/\pi_L-\frac{(1-\pi_L)(X_B+L)}{\pi_L},$$

$$R^{bH}=1/\pi_H-\frac{(1-\pi_H)(X_B+L)}{\pi_H(1-w)}\ \text{(if } (1-w)>X_B+L) \qquad or \qquad R^{bH}=1\ \text{(if } (1-w)\le X_B+L)$$

minimum w that makes the separating condition work, exceeds $(\delta c^r{}_G - \lambda)$, but is smaller than W, a separating equilibrium is only attainable when high quality entrepreneurs contract partial bank finance with the amount of bank debt equal to X_B, the amount of trade credit equal to $(1 - X_B - w)$ and bring in w as additional equity at start-up. In all other cases, the weakly constrained entrepreneur will be indifferent between bringing in more equity at start-up versus credibly promising to bring it in once the bad state of nature realizes.

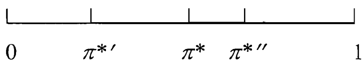
it is optimal for the low quality entrepreneur to contribute only the legal minimum equity and to contract € 1 of bank financing while for the high quality entrepreneur, it is optimal to bring in w in addition to minimum equity and to contract € $(1 - w)$ of bank financing at start-up.[35]

As entrepreneurs are risk averse, the high quality weakly constrained entrepreneur will choose the smallest w that allows dissociation from low quality entrepreneurs. Then, w set according to the following equality:

$$\begin{aligned} &\pi_H \ln\left\{1 + X_G + L - R^{bL} + W\right\} + (1-\pi_H)\ln\left\{1 + W\right\} \\ &= \pi_H \ln\left\{1 + X_G + L - (1-w)R^{bH} + (W - w)\right\} + (1-\pi_H)\ln\left\{1 + W - w\right\} \end{aligned}$$

If there is no solution for w that satisfies the constraint $w \leq W$ given that both π_H and π_L lie *above* π^*, the equilibrium can only be pooling where both low and high quality entrepreneurs borrow exclusively from the bank and bring in only the legal minimum of equity.

We can summarize our discussion by the following figure:



First, note that $\pi^{*\prime} < \pi^*$. This implies that if both high and low quality weakly constrained entrepreneurs find it too costly to borrow exclusively from the bank at start-up – because their firm will be liquidated for sure following default, i.e., $\pi_L < \pi^*$ and $\pi_H < \pi^*$ – then high quality entrepreneurs may still find it affordable to dissociate themselves from lower quality ones by contracting more bank debt than X_B at start-up, knowing that they will have to bring in additional equity in the bad state of nature at time 1, or by bringing in more equity at start-up. This will be the case if $\pi_L < \pi^{*\prime} < \pi_H < \pi^*$. Entrepreneurs for whom control rents only have limited value and who would like to reveal their higher quality will prefer to bring in more equity at start-up, ceteris paribus.

Second, note that $\pi^{*\prime\prime} > \pi^*$. This implies that if both high and low quality weakly constrained entrepreneurs find it optimal to borrow exclusively from the bank at start-up, i.e., $\pi_L >$

[35] Note that the condition $w \leq min\{W, \delta c^r_G - \lambda\}$ is no longer needed here as the decision of bringing in more equity (w)

π^* and $\pi_H > \pi^*$, then high quality entrepreneurs may still find it affordable to dissociate themselves from lower quality ones by bringing in more equity than the legal minimum at start-up. This will be the case if $\pi^* < \pi_L < \pi^{*\prime\prime} < \pi_H$.

Case 1.b. $min\{W, \delta c^r_G - \lambda\} \geq 1 - X_B$

If a weakly constrained entrepreneur borrows the € 1 needed exclusively from the bank, then, given that $min\{W, \delta c^r_G - \lambda\} \geq 1 - X_B$, she is able to and will fully pay off the bank in the bad state at time 1 as only $(1 - X_B)$ is needed to prevent liquidation by the bank. The only price for bank debt that is compatible with zero expected rents in the bank credit market is the risk free rate ($R^b = 1$) as the bank can anticipate that, independent of the perceived firm's credit quality θ, it faces no credit risk. As a result, a weakly constrained entrepreneur who borrows exclusively from the bank is indifferent between bringing in minimum equity and contracting € 1 of bank finance on the one hand, and bringing in € (*legal minimum* + w) in equity (with $0 \leq w \leq W$) and contracting € $(1 - w)$ bank debt on the other hand, even when risk averse.[36]

If a weakly constrained entrepreneur contracts partial bank finance with the amount of bank debt equal to $(X_B + w)$, the amount of trade credit equal to $(1 - X_B - w)$ and $w \leq min\{W, \delta c^r_G - \lambda\}$, then, once the bad state realizes, the bank will again be fully paid off. Therefore, independent of

than the minimum required by law is made (and carried out) at the time of start-up.

[36] Given that the entrepreneur borrows exclusively from the bank, she is indifferent between the following alternatives:

- minimum equity finance and €1 of bank debt
  $\pi_i \ln\{1 + [X_G + L - 1 + W]\} + (1 - \pi_i)\delta \ln\{1 + [c^r_G + X^r_G + W - (1 - X_B)]\} + (1 - \pi_i)(1 - \delta) \ln\{1 + [W - (1 - X_B)]\}$
- maximum equity finance (W + *minimum equity contribution*) and €$(1 - W)$ of bank debt, given that $W < 1$
  $\pi_i \ln\{1 + [X_G + L - (1 - W) + 0]\} + (1 - \pi_i)\delta \ln\{1 + [c^r_G + X^r_G + 0 + (X_B - (1 - W))]\} + (1 - \pi_i)(1 - \delta) \ln\{1 + [0 + (X_B - (1 - W))]\}$
- some intermediate amount of equity (w + *minimum equity contribution*) and €$(1 - w)$ of bank debt, with $0 < w < W$
  if $1 - w \leq X_B$:
  $\pi_i \ln\{1 + [X_G + L - (1 - w) + (W - w)]\} + (1 - \pi_i)\delta \ln\{1 + [c^r_G + X^r_G + (W - w) + (X_B - (1 - w))]\}$
  $+ (1 - \pi_i)(1 - \delta) \ln\{1 + [(W - w) + (X_B - (1 - w))]\}$
  if $1 - w \geq X_B$:
  $\pi_i \ln\{1 + [X_G + L - (1 - w) + (W - w)]\} + (1 - \pi_i)\delta \ln\{1 + [c^r_G + X^r_G + (W - w) - ((1 - w) - X_B)]\}$
  $+ (1 - \pi_i)(1 - \delta) \ln\{1 + [(W - w) - ((1 - w) - X_B)]\}$

It is clear that once the entrepreneur has decided to borrow exclusively from the bank and $min\{W, \delta c^r_G - \lambda\} \geq 1 - X_B$, she is *indifferent* between a financial structure that consists of more (less) equity (and thus less (more) bank debt), even if she is risk averse. As the bank anticipates that it will always be fully paid off at time 1, it charges the risk free rate to entrepreneurs who borrow exclusively from the bank. Then, the entrepreneur always receives the same payoff in each state that realizes at time 1 and financial structure (i.e., the fraction of total finance that is debt versus equity) becomes irrelevant.

the firm's perceived credit quality θ, the bank also charges the risk free rate ($R^b = 1$) to entrepreneurs who borrow only partially from the bank at start-up. However, the entrepreneur cannot credibly commit to the supplier that she will bring in additional equity in the bad state to (partially) pay off the trade credit since the implicit equity stake of the supplier ensures that he will decide in favor of reorganization *with* or *without* some additional equity from the entrepreneur. Therefore, when setting his price for trade credit, the supplier will presume that entrepreneurs will never bring in additional equity in the bad state to reduce his claim.

The separating equilibrium of the previous section, where high quality entrepreneurs borrow exclusively from the bank ($a = 0$) and low quality entrepreneurs apply for partial bank finance ($a > 0$), is preserved when the entrepreneur is no longer strictly constrained given that $min\{W, \delta c'^r_G - \lambda\} \geq (1 - X_B)$. We find that when π_L lies in the interval $[0, \pi^*[$ and π_H lies in the interval $]\pi^*, 1]$, where

$$\pi^* = \frac{\ln\left\{1+c'^r_G+W\right\}^{\delta} - \ln\left\{c'^r_G+X'^r_G+W+X_B\right\}^{\delta} - \ln\left\{W+X_B\right\}^{(1-\delta)} + \ln\left\{1+W\right\}^{(1-\delta)}}{\begin{bmatrix}\ln\left\{X_G+L+W\right\} - \ln\left\{1+X_G+L-X_B-(1-X_B)R^{tL}+W\right\} + \ln\left\{1+W\right\}^{(1-\delta)} \\ + \ln\left\{1+c'^r_G+W\right\}^{\delta} - \ln\left\{c'^r_G+X'^r_G+W+X_B\right\}^{\delta} - \ln\left\{W+X_B\right\}^{(1-\delta)}\end{bmatrix}},$$

$$R^{bH} = 1,$$

$$R^{bL} = 1, \quad R^{tL} = 1/\pi_L - \frac{(1-\pi_L)\delta X'^r_G}{\pi_L(1-X_B)},$$

it is optimal for the low quality entrepreneur to contract partial bank finance ($a > 0$) with the amount of bank debt equal to X_B and the amount of trade credit equal to $(1 - X_B)$, while for the high quality entrepreneur, it is optimal to borrow exclusively from the bank ($a = 0$), but the fraction of total finance that is (bank) debt versus equity is – see footnote 36 – indeterminate when $min\{W, \delta c'^r_G - \lambda\} \geq (1 - X_B)$.

In this separating equilibrium, low quality entrepreneurs have no incentive to demand more bank debt than X_B nor to contribute more equity than the legal minimum because of risk aversion. The proofs of these propositions follow the same logic as in Appendix 5. For high quality entrepreneurs who borrow exclusively from the bank, financial structure (i.e., the fraction of total finance that is debt versus equity) becomes irrelevant when *min{W,* $\delta c^{r}_{G} - \lambda\} \geq (1 - X_B)$.

On the other hand, if the equilibrium is pooling at partial bank finance (when both π_H and π_L lie *below* π^*) or pooling at full bank finance (when both π_H and π_L lie *above* π^*), high quality entrepreneurs may have an incentive to dissociate themselves from low quality entrepreneurs to lower their cost of financing. These two cases are discussed subsequently.

If both π_H and π_L lie *below* the separating condition π^*, then a high quality weakly constrained entrepreneur *might* have an incentive to contract more bank debt than X_B and/or to bring in more equity at start-up to dissociate herself from low quality entrepreneurs once she is no longer strictly constrained.[37,38] In the resulting separating equilibrium, we find that when π_L lies in the interval $[0, \pi^{*\prime}[$ and π_H lies in the interval $]\pi^{*\prime}, 1]$, where

$$\pi^{*\prime}=\frac{\ln\{1+c^{r}_{G}+W\}^{\delta}-\ln\{1+c^{r}_{G}+W-w\}^{\delta}+\ln\{1+W\}^{(1-\delta)}-\ln\{1+W-w\}^{(1-\delta)}}{\begin{bmatrix}\ln\{1+X_G+L-X_B-(1-X_B-w)R^{t\theta,new}+W-w\}+\ln\{1+\delta c^{r}_{G}+W\}+\ln\{1+W\}^{(1-\delta)}\\ -\ln\{1+X_G+L-X_B-(1-X_B)R^{t\theta,new}+W\}-\ln\{1+\delta c^{r}_{G}+W-w\}-\ln\{1+W-w\}^{(1-\delta)}\end{bmatrix}},$$

$$R^{bH}=1,\ R^{bL}=1,$$

$$R^{t\theta,new}=\frac{(1-X_B)-\alpha w-(1-\theta)\delta X^{r}_{G}}{[\theta(1-X_B)-\alpha\pi_H w]},$$

it is optimal for the low quality entrepreneur to contract partial bank finance ($a > 0$) with the amount of bank debt equal to X_B and the amount of trade credit equal to $(1 - X_B)$, while for the high

[37] Here, high quality entrepreneurs who have an incentive to dissociate themselves from low quality entrepreneurs are *totally indifferent* between contracting partial bank finance with $(X_B + w)$ of bank debt, $(1 - X_B - w)$ of trade credit and bringing in minimum equity on the one hand and contracting partial bank finance with X_B of bank debt, $(1 - X_B - w)$ of trade credit and bringing in w as additional equity beyond the minimum on the other hand. This results from *min{W,* $\delta c^{r}_{G} - \lambda\} \geq (1 - X_B)$.

[38] A specific feature of the model where *min{W,* $\delta c^{r}_{G} - \lambda\} \geq (1 - X_B)$ is that when the entrepreneur decides to contract partial bank finance with $(X_B + w)$ of bank debt and $(1 - X_B - w)$ of trade credit and chooses to set a w different from zero, the maximum possible value for w – given that the entrepreneur needs only €1 of additional finance beyond the legal minimum equity – that she can set is $w = (1 - X_B)$. This situation is identical to the one where she decides to borrow exclusively from the bank. Then, the separating equilibrium of the previous section where a low quality entrepreneur contracts X_B of bank debt and $(1 - X_B)$ of trade credit and a high quality entrepreneur contracts $(X_B + w)$ of bank debt and $(1 - X_B - w)$ of trade credit <u>*coincides*</u> with the separating equilibrium where a low quality entrepreneur contracts X_B of bank debt and $(1 - X_B)$ of trade credit and a high quality entrepreneur borrows exclusively from the bank.

quality entrepreneur, it is optimal to contract partial bank finance ($a > 0$) with the amount of trade credit equal to $(1 - X_B - w)$. Moreover, high quality entrepreneurs are indifferent between contracting $(X_B + w)$ of bank debt at start-up and then bringing in w in the bad state on the one hand, and contracting X_B of bank debt and contributing *€ (legal minimum + w)* in equity at start-up on the other hand.

As entrepreneurs are risk averse, the high quality weakly constrained entrepreneur will choose the smallest w that allows dissociation from low quality entrepreneurs. Then, w is set according to the following equality:

$$\begin{aligned}
&\pi_H \ln\left\{1 + X_G + L - (X_B + w) - (1 - X_B - w)R^{t\theta,new} + W\right\} \\
&\quad + (1-\pi_H)\delta \ln\left\{1 + \delta c^r{}_G + W - w\right\} + (1-\pi_H)(1-\delta)\ln\{1 + W - w\} \\
&= \pi_H \ln\left\{1 + X_G + L - X_B - (1 - X_B)R^{t\theta,new} + W\right\} \\
&\quad + (1-\pi_H)\delta \ln\left\{1 + \delta c^r{}_G + W\right\} + (1-\pi_H)(1-\delta)\ln\{1 + W\}
\end{aligned}$$

If there is no solution for w that satisfies the constraint $w \leq W$ given that both π_H and π_L lie *below* π^*, the equilibrium can only be pooling at partial bank finance. Then, both low and high quality entrepreneurs set the amount of bank debt equal to X_B, the amount of trade credit equal to $(1 - X_B)$ and no entrepreneur has an incentive to contribute more equity than the legal minimum.

If both π_H and π_L lie *above* the separating condition π^*, then a high quality weakly constrained entrepreneur can no longer dissociate herself from low quality entrepreneurs by bringing in more equity at start-up (and, thus, demanding less external (bank) finance) given that $min\{W, \delta c^r{}_G - \lambda\} \geq (1 - X_B)$. We have shown above – see footnote 36 – that financial structure is totally irrelevant for wealthy entrepreneurs with large control rents who borrow exclusively from the bank.

Case 2: The Going Concern Value Exceeds the Liquidation Value

If the firm's going concern value exceeds its liquidation value ($\delta X^r{}_G \geq L$), both the bank and the supplier will decide to reorganize following the realization of the bad state of nature. If a high quality weakly constrained entrepreneur has no incentive to signal her higher quality by bringing in more equity at start-up, the equilibrium modeled will be pooling. On the contrary, if she brings in more equity at start-up, the equilibrium might become separating. As only the bank adjusts its credit rate to perceived credit quality, a high quality entrepreneur who has an incentive to bring in more equity at start-up, will borrow exclusively from the bank to minimize her cost of finance. In the resulting equilibrium, rational suppliers anticipate that henceforth only low quality entrepreneurs still apply for trade credit and therefore, the equilibrium price of trade credit will be adjusted upwards in order for the supplier to still break even on his lending. Then, a low quality entrepreneur becomes indifferent between borrowing exclusively from the bank, borrowing exclusively from the supplier or some combination of bank debt and trade credit. This case is discussed in detail in Appendix 6.

V. Empirical Evidence

In this section, we investigate whether the above developed theoretical model is empirically supported using data on 152 true start-ups in Belgian manufacturing, all founded in 1992. Since limited liability firms have to file their annual accounts with the Belgian National Bank, we were able to collect the financial statements of these start-ups and their industry counterparts. Also, start-ups are legally obliged to publish an abstract from their foundation charter, which contains details on ownership structure. Table I gives information on the industry distribution of the sample firms, based on their two-digit NACE code. In Table II, we provide summary statistics on the start-ups included in our sample. First, we observe that these firms are rather small at the time of start-up: the average firm employs 2.70 persons (median of one), whereas its total resources amount to € 198262 in the start-up year. Since total assets is less than total resources, it can be inferred that the average firm incurs (accounting) losses during the start-up year. Next, the start-ups are highly levered; on average, 68.97% of initial resources is raised as external debt financing. The median even points to a higher share of external debt as a source of capital. Bank debt represents only

30.78% of total external debt in the average firm. The maturity structure of debt indicates that 68.64% of total external debt has a maturity not exceeding one year in the start-up year. When considering bank debt only, short-term bank debt on average represents 26.64% of total bank debt. Finally, we observe that initial ownership is highly concentrated in these firms: the average herfindahl shareholder concentration index amounts to 66.35%.

To measure the theoretical constructs – control rents ($c^r{}_G$), entrepreneurial wealth (W), expected cash flows (X_G, X_B, $X^r{}_G$), asset liquidation value (L), average entrepreneurial quality (α) – empirically, we make use of proxy variables. Control rents are measured by a dummy variable that is set to one when the company's name contains the name of the entrepreneur(s) and zero otherwise. Entrepreneurs who clearly identify themselves with their firm by assigning their name to the company can be expected to enjoy higher private benefits from control. In addition, once the venture goes bankrupt, the reputation of the entrepreneur may be seriously damaged. It is widely known that in Continental Europe and Japan, entrepreneurs who fail in their venture are stigmatized (e.g., Sahlman (1990)). Wright et al. (1997), for instance, find that longer established venture capitalists evaluate first-time and serial entrepreneurs differently and that previous entrepreneurial performance influences the provision of funds for serial entrepreneurs. Reputation effects can be expected to be especially prevalent for entrepreneurs who can be readily recognized from their firm's name. In addition, we use the industry unemployment rate in the year preceding entry and the age of the entrepreneur at start-up to check the robustness of our results. In industries where unemployment rates are high, entrepreneurs may attribute a higher value to remaining in control, ceteris paribus. Next, entrepreneurs of older age may be more risk averse (e.g., Evans and Jovanovic (1989)) and may have few job market opportunities once their venture fails (e.g., Scott, Berger and Garen (1995), Johnson and Neumark (1997)). We create a dummy variable that is set to one when the average age in the entrepreneurial team is above the sample median (34 years) and zero otherwise; we only have data on 64 start-ups to calculate this variable. Since we have no information on the entrepreneurs' personal finances, we use the amount of equity issued at start-up as a proxy for entrepreneurial wealth, though recognize that this proxy may be flawed. The logarithm of this variable is taken to avoid heteroscedasticity problems. The start-up's expected cash flows are proxied by industry profitability, which is measured by EBITD relative to total assets during the year 1991, averaged across all firms in the corresponding industry. The liquidation value of firm assets is proxied by the percentage of total assets that consist of tangibles in the corresponding industry in 1991. To measure average entrepreneurial quality, we use the industry failure (bankruptcy) rate of earlier start-ups, founded in 1988-1991. Since late bankruptcy likely is related to factors other than an inherent quality deficiency, we follow these firms during the first three years subsequent to start-up. Table III provides summary information on these proxy variables.

For the purpose of testing our theoretical model, we use logit regression analysis. After all, the model predicts which entrepreneurs prefer to finance exclusively with bank debt rather than to raise a combination of bank and trade credit at start-up. This feature can be captured best by constructing a dummy variable. The dependent variable FULL BANK therefore is set to one when the entrepreneurial firm solely raises bank debt in the start-up year and zero otherwise. However, when constructing this dummy variable, we need to take into account that suppliers may allow their customers to delay payment obligations during a certain period after delivery, without there being a cost associated with trade credit. In fact, using bank debt to bridge this period would have an important opportunity cost. As a result, not all firms with a positive ratio of trade credit outstanding relative to purchases should be assigned a value of zero for the variable FULL BANK. In our sample, 96.05% of firms have a non-zero value for the ratio of trade credit to purchases.

In the case of *one-part* credit terms, no discount is granted for early payment and full payment is due at the end of the net period. Then, it is in every firm's best interest to pay only at the end of that period. In the case *two-part* credit terms are offered, firms receive a discount for prompt period, i.e. payment within the discount period. From reported discount rates, it can be inferred that the implicit interest rate on trade credit is very high, making it an expensive source of financing.[39] If firms prefer to forego this discount, then full payment is due by the end of the net period. Ng, Smith and Smith (1999) find that a substantial fraction of the firms in their sample do not permit customers to extend the net period and/or take unearned discounts. Also, those suppliers that extend the net period and/or accept discounted payments during the net period are mostly willing to do so when the buyer has a long-standing relationship with them. The latter condition certainly is not the case for newly established firms at the time of start-up and, therefore, the industry trade credit standard can be used as the dividing line for firms that use versus firms that do not use expensive vendor financing. A final concern may be that entrepreneurial firms experience a sudden boost in sales (and thus purchases) once the business gets on its cruising speed. Then, the correction for the length of the first accounting year – i.e., purchases are scaled to a horizon of twelve months – may not be satisfactory and may lead to substantial outliers for the ratio of accounts payable to purchases; accounts payable only relate to the latest purchases of the accounting period whereas purchases, after the correction, relate to the preceding 12 months.

We first use *one-part credit terms* to determine whether start-ups use full versus partial bank finance. Ng, Smith and Smith (1999) find that "Net 30" is by far the most commonly used one-part term. Then, entrepreneurs are required to pay within 30 days after the invoice date and no discount is offered for earlier payment. Under these conditions, it can be expected that firms will postpone their payments until day 30, without this having to imply that firms prefer to finance partly with trade credit. However, some firms may over-use trade credit, i.e. behind the granted period. These firms are likely to incur high costs, partly through the signal that they are giving. The dependent variable FULL BANK, therefore, is set to one for start-ups with a positive amount of bank debt and for whom the ratio of accounts payable to purchases is below 0.0833 (=1/12) and zero otherwise. The results in Table IV indicate that the probability of financing exclusively with bank debt is lower for entrepreneurs who highly value control rights. However, this is only significantly so when control rents are measured by means of the name dummy variable (column

[39] Frequently reported percentages indicate that the implicit interest rate on trade credit amounts to 44% (e.g., Biais and

one). Entrepreneurial age is likely to be also related to personal wealth, which might explain its insignificance in column two; personal wealth is expected to positively influence the probability of borrowing solely from banks at start-up. In column three, the industry unemployment rate is not significantly related to the probability of borrowing exclusively from the bank at start-up. A possible explanation might be that high potential individuals are the ones that found their own firm. Then, industry unemployment rates may provide relatively few information on alternative employment opportunities. Next, we find that the liquidation value of assets significantly reduces the likelihood that entrepreneurs finance exclusively with bank debt at start-up, ceteris paribus. This result is consistent with the argument that entrepreneurs take into account that banks may adopt a harder liquidation policy for firms that default, especially when the liquidation value of assets is high. Similar conclusions are obtained when using the percentage of assets that are relatively liquid (accounts receivable, cash and marketable securities) to measure the asset liquidation value (column four).

The amount of equity issued at start-up, industry profitability and industry failure risk, however, do not impact upon the debt structure. The robustness of these results is discussed hereafter. First, we have already suggested that the amount of equity issued at start-up may be a flawed measure of entrepreneurial wealth. For instance, entrepreneurs who contribute more equity at start-up may be more averse to taking risks because more of their personal wealth is at stake. Then, the equity contribution made at start-up does not proxy for entrepreneurial wealth, but for entrepreneurial risk aversion. When we include a dummy variable that is set to one when the entrepreneurial team consists of more than one member and zero otherwise, we observe that this variable is positively, though insignificantly related to the probability of borrowing exclusively from the bank. The variable equity contribution now has a significant negative impact upon the probability of raising only bank debt, ceteris paribus (column five). This result is consistent with the theoretical model, demonstrating that individual risk aversion – captured by the risk premium λ

Gollier (1997), Ng, Smith and Smith (1999)).

– negatively influences the entrepreneur's choice to finance exclusively with bank debt. Second, to test the robustness of the insignificant relation between industry profitability and the probability of full bank finance, we also calculate other measures of industry profitability, such as the ratio of net income to total assets, but still fail to find that industry profitability affects the debt mix. The same conclusion is obtained from using sales and the number of employees as the scaling variable. Third, we calculate the industry volatility of cash flows to test the robustness of the insignificant relation between the industry failure rate and the debt mix. To correct for a time trend in the data, we use volatility of cash flow growth rates over 1988-1991, but continue to find that no relationship exists between the industry failure rate and the debt mix. However, once we allow for a quadratic term in the industry failure rate, we find that entrepreneurs in industries where the failure rate of newly established firms is relatively high prefer to raise a combination of bank debt and trade credit at start-up, ceteris paribus (column six). The cuttoff value for the industry failure rate occurs at about 12.06%. To deal with the above mentioned concern that some firms may exhibit a sudden take-off in sales by the end of the first accounting period, we also report results considering only the firms that are assigned the same value for the dummy variable FULL BANK, when using data from the second accounting period. These results are reported in column seven. Finally, in column eight, we report the results from removing the firms with a ratio of accounts payable to purchases greater than one. The results in column seven and eight essentially confirm earlier conclusions.

Next, we use *two-part credit terms* to determine whether firms use full versus partial bank finance during the start-up year. Chant and Walker (1988), Ng, Smith and Smith (1999) and others show that there is considerable variation across industries and little variation within industries with respect to two-part credit terms. Therefore, using accounting data on the established firms in the industry, we calculate the industry trade credit standard. This variable is defined as the mode of the ratio of accounts payable to purchases of goods and services, computed across all industry incumbents in 1991. As trade credit is an expensive source of finance, it can be expected that the more established and more creditworthy firms in the industry will largely take the discount for payment within the discount period. Therefore, we only consider firms older than ten years and with no accumulated losses when calculating the industry standard. The mode is used since it can be expected that even if some of these incumbents anticipate that they can extend their trade credit use behind the granted terms (e.g., Ng, Smith and Smith (1999)), deviations from the standard will be arbitrarily. In other words, there is no reason to expect firms in default on their trade credit and that decide to still fulfill their payment obligations to do so on the same day. The dependent variable FULL BANK, therefore, is set to one for start-ups with a positive amount of bank debt and for whom the ratio of accounts payable to purchases is below the industry standard and zero otherwise. In Panel B of Table V, we use firms from the corresponding two-digit, respectively three-digit NACE industry to determine the industry standard. Our earlier conclusions from Panel A are basically unaffected and, therefore, will not be repeated here. Also, from comparing the adjusted R-square of the models based one-part versus two-part credit terms, we can conclude that all models have a highly comparable explanatory power. This result is not surprising given that for 91.45% of all start-ups, the three definitions of the variable FULL BANK result in the same classification; in other words, vendor financing is either used scarcely or used abundantly by start-ups.

In Tables V and VI, we provide the results from split sample regression analysis, where we discern firms on the basis of the liquidation value of their assets. After all, it was argued in the previous section that the theoretical model only holds when the liquidation value of assets is high. To determine whether the asset liquidation value is high (low), we rank industries on the basis of the percentage of industry assets that are liquid (accounts receivable, cash and marketable securities) and use the median of this ranking variable to split the sample – above versus below the median. These results are reported in Table V. Likewise, we use the extent of growth opportunities, which is measured by the average industry cash flow growth rate over 1988-1991, to compare start-ups; firms with substantial growth opportunities are likely to have a low assets' liquidation value, ceteris paribus. These results are reported in Table VI.

The results in Tables V and VI are qualitatively similar. First, control rents significantly and negatively influence the likelihood of borrowing exclusively from the bank, but only when assets are highly liquid and/or growth opportunities are limited. Under these circumstances, the liquidation value of firm assets can be expected to be relatively high, ceteris paribus. Second, the equity contribution made at start-up negatively influences the likelihood of contracting full bank finance, independent of the liquidation value of firm assets. Third, the industry failure rate has a negative impact upon the probability of full bank finance, but only significantly so when the percentage of total assets that consist of liquid assets is relatively high. Overall, these results are consistent with the predictions of our model. From comparing the adjusted R-square across the different models, we can conclude that our model does better in explaining the financing choice of firms in industries where the liquidation value of assets is relatively high.

VI. Conclusions

The main point of this paper is that entrepreneurs who contract debt to finance their business venture not only consider the price of the different sources of credit; they also take other costs into account. We focus on the difference in liquidation policy of various lenders and its implications for losing private benefits of control. It is shown that suppliers, due to a larger implicit equity stake in their customers, adopt a more lenient liquidation policy than banks, but charge a higher price for their credit. The entrepreneur, being uncertain about the success probability of her venture, may then prefer to limit her bank borrowings at start-up to avoid a potential default against the bank later on.

Given that the entrepreneur has brought in all her personal wealth as equity at start-up to meet the minimum equity contribution for limited liability firms, the fraction of total finance that consists of external debt versus internal equity cannot play a signaling role: the fraction of total finance that is debt will be determined by the need for funds to finance the project, which is unrelated to entrepreneurial quality for start-up firms.[40] Though, the fact that the entrepreneur borrows exclusively from the bank *might* be an important quality signal: when the firm's going concern value exceeds its liquidation value, we show that financial structure at start-up (i.e., the proportion of debt finance that is bank versus trade credit) is irrelevant since both the bank and the supplier will prefer to reorganize following default. On the other hand, if the firm's liquidation value exceeds its going concern value, we show that entrepreneurs, depending on their perceived credit quality, may prefer a particular debt structure such that financiers can infer entrepreneurial quality. Entrepreneurs who face a low probability of financial distress borrow exclusively from the bank to limit their financing expenses. For these firms, the small chance that control rents will be lost following default does not offset the lower price of external finance that is obtained by borrowing exclusively from the bank. Entrepreneurs who face a high probability of financial distress, on the other hand, limit their bank borrowings in order to preserve control following default. Then, default will only occur against the supplier, who will decide to reorganize the defaulted claims given his implicit equity stake in the firm.

Given that the entrepreneur does not need to bring in all her personal wealth as equity at start-up to meet the minimum equity contribution for limited liability firms, we find that the conclusions from the above model are preserved. When the firm's liquidation value exceeds its going concern value, the supplier's implicit equity stake again might induce entrepreneurs to adjust their capital structure. Entrepreneurs with important control rents, for instance, may limit their bank borrowings such that default against the bank can always be circumvented. However, by bringing in more equity and/or contracting more debt as bank finance at start-up, entrepreneurs who prefer to raise a combination of bank and vendor financing may be able to further reduce the price of external finance through the signal that they are giving. Entrepreneurs who borrow exclusively from the bank, on the other hand, may be able to signal their higher quality by increasing their

[40] For incumbent firms, it can be expected that firms of higher quality have been able to build up (more) financial slack (retained earnings), which would reduce their need for external funds to finance investment projects. This relation is the basis for Myers' (1984) pecking order theory of capital structure.

equity contribution (and, thus, contracting less debt finance). Simulations indicate that entrepreneurs of higher quality, with higher control rents, more personal wealth and a lower probability that the good state of nature will realize at time 2 following default at time 1 need to give a stronger quality signal in order for their signal to be credible. Also, if entrepreneurs are extremely wealthy, we show that the fraction of total finance provided by the entrepreneur (equity) can no longer play any signaling role. On the other hand, if the firm's going concern value exceeds its liquidation value, entrepreneurs who face a low probability of financial distress now may be able to use the fraction of total finance that they provide (i.e., internal equity versus external debt) as a quality signal. Then, the remaining finance needed will be borrowed exclusively from the bank to obtain the lowest price for external financing. Also, entrepreneurs who face a high probability of financial distress will be indifferent between contracting bank versus supplier finance as both creditors will charge the same price for credit.

Overall, these results stress the crucial role played by the relation between the liquidation value of firm assets and the firm's going concern value. We explicitly demonstrate that the supplier's implicit equity stake only has specific implications for the debt structure of start-ups when the liquidation value of assets is relatively high when compared to the firm's going concern value. As a result, our model mainly has implications for start-ups in traditional industrial sectors. The debt structure of start-ups in new sectors where intangibles play an important role, such as biotechnology, information technology, etc. cannot be explained by this model. For these firms, the liquidation value of assets is likely to be relatively low. Furthermore, these firms are likely to be financed with equity (venture capital) rather than with debt financing.

Table 1: Industry distribution of sample firms

This Table represents the number of sample firms that start up in each two-digit NACE industry.

NACE	Description	Number of firms
22	Production and preliminary processing of metals	1 firm
23	Extraction of minerals other than metalliferous and energy-producing minerals; peat extraction	1 firm
24	Manufacture of non-metallic mineral products	2 firms
25	Chemical industry	4 firms
31	Manufacture of metal articles (except for mechanical, electrical and instrument engineering and vehicles)	9 firms
32	Mechanical engineering	5 firms
34	Electrical engineering	7 firms
36	Manufacture of other means of transport	1 firm
37	Instrument engineering	4 firms
41/42	Food, drink and tobacco industry	20 firms
43	Textile industry	9 firms
44	Leather and leather goods industry (except footwear and clothing)	3 firms
45	Footwear and clothing industry	13 firms
46	Timber and wooden furniture industries	17 firms
47	Manufacture of paper and paper products; printing and publishing	44 firms
48	Processing of rubber and plastics	4 firms
49	Other manufacturing industries	8 firms
TOTAL		152 firms

Table II: Summary statistics on firm start-up size, initial financial structure and ownership structure

This Table represents summary statistics on variables that represent firm start-up size, initial financial structure and ownership structure. Firm *start-up size* is measured in terms of number of employees, total resources and total assets in the start-up year. *Leverage* is the ratio of total, externally raised debt to total resources in the start-up year. Initial resources do not incorporate the operational results realized during the first year, whereas loans provided by the entrepreneurs to their firm are considered as equity finance. *Short-term debt* consists of debt with a maturity not exceeding one year, and *shareholder concentration* is measured by the herfindahl shareholder concentration index.

Variable	Mean	Median	Minimum	Maximum	Std. dev
START-UP SIZE					
Number of employees	2.6993	1	0	18	3.6958
Total resources	198262€	89068€	4908€	2656006€	337049€[2]
Total assets	185626€	85945€	2454€	2352212€	315849€[2]
INITIAL FINANCIAL STRUCTURE					
Leverage	0.6897	0.7710	0	0.9915	0.2487
Bank debt/total debt	0.3078	0.2688	0	0.9810	0.2945
Bank debt/total debt if positive	0.4372	0.4504	0.0022	0.9810	0.2577
Short-term debt/total debt	0.6864	0.7568	0.0180	1	0.3080
Short-term bank debt/bank debt	0.2664	0	0	1	0.3828
OWNERSHIP STRUCTURE					
Shareholder concentration	0.6635	0.52	0.1534	1	0.2677

Table III: Summary statistics on explanatory and control variables

This Table represents summary statistics on explanatory and control variables. *Name dummy* is set to one if the name of the firm contains the name of the entrepreneur(s) and zero otherwise. The *industry unemployment rate* represents the unemployment rate in the corresponding industry during the year preceding entry. The entrepreneurial age dummy is set to one when the mean age in the entrepreneurial team exceeds the median and zero otherwise.

Variable	Mean	Median	Minimum	Maximum	Std. dev
CONTROL RENTS (c^r_G)					
Name dummy	0.2418	0	0	1	0.4296
Industry unemployment rate	0.1063	0.0865	0.0200	0.4350	0.0616
Entrepreneurial age dummy	0.4918	0	0	1	0.5041
ENTREPR. WEALTH (W)					
Logarithm of equity	6.5540	6.6201	4.0943	10.0433	1.0101
EXP. CASH FLOWS (X_G, X_B, X^r_G)					
Industry EBITD/total assets	0.1559	0.1561	−0.1045	0.5901	0.0790
Industry net income/total assets	0.0177	0.0096	−0.0460	0.0934	0.0143
ASSET LIQUIDATION VALUE (L)					
Industry tangible assets/total assets	0.7089	0.7171	0.2752	0.8767	0.1303
Industry liquid assets/total assets	0.4292	0.4414	0.0877	0.8013	0.0990
AVERAGE ENTREPR.QUALITY (α)					
Industry start-up failure rate	0.0563	0.0551	0	0.5	0.0505
Industry cash flow growth volatility	0.4611	0.3503	0.0509	2.5851	0.3551

Table IV: Logit regression results

Panel A of this Table represents various models where the net term "Net 30" is used to determine whether start-up firms borrow exclusively from the bank (FULL BANK = 1), respectively raise a combination of bank debt and vendor financing (FULL BANK = 0). The model estimates the probability of borrowing solely from the bank at start-up. In column one, control rents are measured by a dummy variable that is set to one when the company name contains the name of the entrepreneur and zero otherwise, the equity contribution is measured by the logarithm of issued equity, industry profitability is measured by EBITD to total assets averaged across all firms in the corresponding industry in 1991, the liquidation value of firm assets is measured by the percentage of total assets that consist of tangibles in the corresponding industry, industry failure risk is measured by the bankruptcy rate of earlier start-ups. In column two and three, the industry unemployment rate, respectively the average age in the entrepreneurial team are used to proxy for entrepreneurial control rents. In column four, the asset liquidation value is measured by the percentage of firm assets that are liquid (accounts receivable, cash and marketable securities). In column five, a dummy variable is added that is set to one when the entrepreneurial team consists of more than one member and zero otherwise. In column six, we allow for a quadratic term in the industry failure rate. In column seven and eight, we remove firms that may have a biased value for the ratio accounts payable to purchases (and thus for the dummy variable FULL BANK) from the sample. In column seven, we remove firms that are classified differently using second year accounting data, whereas in column eight, we remove firms for whom the ratio of accounts payable relative to purchases is above one. Panel B of this Table represents results where the industry standard for accounts payable relative to purchases at the two-digit, respectively three-digit industry level is used to determine the dividing line for the dummy variable FULL BANK.

	PANEL A One-part credit terms								PANEL B Two-part credit terms	
									2 digit	3 digit
Intercept	5.4876**	4.4830*	6.1305**	5.7425*	11.4129***	11.6525**	11.1379**	12.1629***	10.5642**	11.1495***
Control rents	−1.7000**	−0.3290	−0.5577	−1.6477**	−2.0020**	−2.0633**	−1.8926*	−2.0753**	−1.2324**	−1.0664*
Equity contribution	−0.6206	−0.5616	−0.9947	−0.7036*	−1.3885**	−1.4464**	−1.4058**	−1.4673**	−1.4051***	−1.3712***
Number of shareholders					0.0317	0.0301	0.1711	−0.0878	0.3515	0.1024
Industry profitability	−0.3814	−0.5278	−9.1537	−1.8616	−0.6147	−0.5035	−0.8802	−0.1597	−0.9724	−0.5758
Liquidation value of assets	−3.5290**	−3.0048*	0.6512	−4.4035*	−4.2491**	−5.6545**	−5.1133**	−6.1222**	−3.8639**	−4.9419***
Industry failure risk	−0.5939	0.1136	6.4308	0.6173	−2.0246	0.4712*	0.4304*	0.4797*	0.4299**	0.3733*
(Industry failure risk)^2						−3.9065*	−3.4739*	−3.8749*	−3.8041**	−3.3305*
Number of observations	152	152	64	152	152	152	123	137	152	152
Adjusted R-square	0.0878	0.0456	0.0806	0.0807	0.1240	0.1561	0.1573	0.1642	0.1471	0.1401

***: significant at 1%
**: significant at 5%
*: significant at 10%

Table V: Logit regression results – split sample regression results

This Table represents the model of column six of the Table IV, but where the sample is split on the basis of the liquidation value of firm assets. The industry average of the variable liquid assets (accounts receivable, cash and marketable securities) to total assets is used to split the sample.

	Industry liquid assets/total assets			
	LOW	***p*-value**	**HIGH**	***p*-value**
Intercept	16.6286	0.0516	9.3900	0.1273
Control rents	–1.2044	0.3873	–2.5426	0.0262
Equity contribution	–2.1241	0.0487	–1.3076	0.1326
Number of shareholders	–0.8483	0.3055	0.5988	0.5011
Industry profitability	–7.8337	0.3674	0.1483	0.9633
Liquidation value of assets	–2.3388	0.5861	–5.4308	0.1346
Industry failure risk	0.2282	0.6907	0.7043	0.0568
(Industry failure risk)^2	–4.0925	0.5423	–5.3990	0.0475
Adjusted R-square		0.1120		0.2375

Table VI: Logit regression results – split sample regression results

This Table represents the model of column six of the Table IV, but where the sample is split on the basis of the liquidation value of firm assets. The industry average of the cash flow growth rate is used to split the sample.

	Industry growth opportunities (historical cash flow growth)			
	LOW	***p*-value**	**HIGH**	***p*-value**
Intercept	13.6636	0.0670	10.6569	0.0507
Control rents	–2.3786	0.0852	–0.5674	0.5236
Equity contribution	–1.8502	0.0682	–1.1424	0.1106
Number of shareholders	–0.6933	0.3520	0.6258	0.4992
Industry profitability	–8.8163	0.1221	2.4838	0.5549
Liquidation value of assets	–1.4613	0.5983	–8.2595	0.0192
Industry failure risk	0.3138	0.2908	0.2601	0.4257
(Industry failure risk)^2	–3.1173	0.1898	–2.2035	0.4309
Adjusted R-square		0.1861		0.1373

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Appendix 1: separating π^*

In this Appendix, the incentive compatibility constraints for a separating equilibrium where high quality entrepreneurs borrow exclusively from the bank and low quality entrepreneurs contract partial bank finance are derived. If an entrepreneur borrows exclusively from the bank (a = 0) then in a separating equilibrium, the bank infers $\pi = \pi_H$ and charges the corresponding bank rate R^{bH} while if she contracts partial bank finance (a > 0) then both creditors infer $\pi = \pi_L$ and charge the bank rate R^{bL}, respectively supplier rate R^{tL}. The truth telling conditions for a high, respectively low quality entrepreneur imply the following boundary condition on entrepreneurial quality:

Truth telling condition for an entrepreneur with $\pi = \pi_H$:

$$\pi_H \ln\left\{1+\left[X_G + L - R^{bH}\right]\right\}+(1-\pi_H)\ln\{\,1\,\}$$
$$> \pi_H \ln\left\{1+\left[X_G + L - X_B R^{bL} - (1-X_B)R^{tL}\right]\right\}+(1-\pi_H)\delta\ln\left\{1+\left[c^r{}_G\right]\right\}+(1-\pi_H)(1-\delta)\ln\{\,1\,\}$$

(expected utility from setting a = 0 > expected utility from setting a = (1 – X_B))

$$\pi_H > \frac{\ln\left\{1+c^r{}_G\right\}^{\delta}}{\ln\left\{1+X_G+L-R^{bH}\right\}-\ln\left\{1+X_G+L-X_B-(1-X_B)R^{tL}\right\}+\ln\left\{1+c^r{}_G\right\}^{\delta}}$$

where R^{bH} is set to achieve zero expected profits (i.e., the expected payoff from the loan $\pi_H R^{bH}$ + $(1-\pi_H)(X_B + L)$ should equal the amount initially invested of €1) or

$$R^{bH} = 1/\pi_H - \frac{(1-\pi_H)(X_B+L)}{\pi_H}$$

R^{bL} is set to achieve zero expected profits (i.e., the expected payoff from the loan $\pi_L X_B R^{bL}$ + $(1-\pi_L)X_B R^{bL}$ should equal the amount initially invested of €X_B) or

$$R^{bL} = 1$$

R^{tL} is set to achieve zero expected profits (i.e., the expected payoff from the loan $\pi_L(1-X_B)R^{tL} + (1-\pi_L)\delta X^r{}_G$ should equal the amount initially invested of €$(1-X_B)$) or

$$R^{tL} = 1/\pi_L - \frac{(1-\pi_L)\delta X^r{}_G}{\pi_L(1-X_B)}$$

Truth telling condition for an entrepreneur with $\pi = \pi_L$:

$$\pi_L \ln\left\{1+\left[X_G + L - R^{bH}\right]\right\}+(1-\pi_L)\ln\{\,1\,\}$$
$$< \pi_L \ln\left\{1+\left[X_G + L - X_B R^{bL} - (1-X_B)R^{tL}\right]\right\}+(1-\pi_L)\delta\ln\left\{1+\left[c^r{}_G\right]\right\}+(1-\pi_L)(1-\delta)\ln\{\,1\,\}$$

(expected utility from setting a = 0 < expected utility from setting a = (1 – X_B))

$$\pi_L < \frac{\ln\left\{1+c^r{}_G\right\}^\delta}{\ln\left\{1+X_G+L-R^{bH}\right\}-\ln\left\{1+X_G+L-X_B-(1-X_B)R^{tL}\right\}+\ln\left\{1+c^r{}_G\right\}^\delta}$$

Appendix 2: first order derivatives

The following formula was derived to determine the cutoff π^*:

$$\pi^* = \frac{\ln\left\{1+c^r{}_G\right\}^\delta}{\ln\left\{1+X_G+L-R^{bH}\right\}-\ln\left\{1+X_G+L-X_B-(1-X_B)R^{tL}\right\}+\ln\left\{1+c^r{}_G\right\}^\delta}$$

Below, we show that $\partial\pi^*/\partial R^{tL} < 0$, $\partial\pi^*/\partial R^{bH} > 0$, $\partial\pi^*/\partial X_G > 0$, $\partial\pi^*/\partial X_B > 0$, $\partial\pi^*/\partial X^r{}_G > 0$, $\partial\pi^*/\partial c^r{}_G > 0$ and $\partial\pi^*/\partial\delta > 0$. The sign of $\partial\pi^*/\partial L$ is not unambiguously clear.

$$\partial\pi^*/\partial R^{tL} = \frac{-\ln\left\{1+c^r{}_G\right\}^\delta\left[\dfrac{1-X_B}{1+X_G+L-X_B-(1-X_B)R^{tL}}\right]}{\left[\ln\left\{1+X_G+L-R^{bH}\right\}-\ln\left\{1+X_G+L-X_B-(1-X_B)R^{tL}\right\}+\ln\left\{1+c^r{}_G\right\}^\delta\right]^2} < 0$$

$$\partial\pi^*/\partial R^{bH} = \frac{-\ln\left\{1+c^r{}_G\right\}^\delta\left[\dfrac{-1}{1+X_G+L-R^{bH}}\right]}{\left[\ln\left\{1+X_G+L-R^{bH}\right\}-\ln\left\{1+X_G+L-X_B-(1-X_B)R^{tL}\right\}+\ln\left\{1+c^r{}_G\right\}^\delta\right]^2} > 0$$

$$\partial\pi^*/\partial X_G = \frac{-\ln\left\{1+c^r{}_G\right\}^\delta\left[\dfrac{1}{1+X_G+L-R^{bH}}-\dfrac{1}{1+X_G+L-X_B-(1-X_B)R^{tL}}\right]}{\left[\ln\left\{1+X_G+L-R^{bH}\right\}-\ln\left\{1+X_G+L-X_B-(1-X_B)R^{tL}\right\}+\ln\left\{1+c^r{}_G\right\}^\delta\right]^2} > 0$$

$$\partial\pi^*/\partial X_B = \frac{-\ln\left\{1+c^r{}_G\right\}^\delta\left[\dfrac{(1-\pi_H)/\pi_H}{1+X_G+L-R^{bH}}-\dfrac{-1+R^{tL}+\left[(1-X_B)(1-\pi_L)\delta X^r{}_G\right]/\left[\pi_L(1-X_B)^2\right]}{1+X_G+L-X_B-(1-X_B)R^{tL}}\right]}{\left[\ln\left\{1+X_G+L-R^{bH}\right\}-\ln\left\{1+X_G+L-X_B-(1-X_B)R^{tL}\right\}+\ln\left\{1+c^r{}_G\right\}^\delta\right]^2}$$

with $-1+R^{tL}+\dfrac{(1-X_B)(1-\pi_L)\delta X^r{}_G}{\pi_L(1-X_B)^2} = -1+\left[1/\pi_L-\dfrac{(1-\pi_L)\delta X^r{}_G}{\pi_L(1-X_B)}\right]+\dfrac{(1-\pi_L)\delta X^r{}_G}{\pi_L(1-X_B)}$

$= (1-\pi_L)/\pi_L$

$$= \frac{-\ln\{1+c^r{}_G\}^{\delta}\left[\dfrac{1}{(1+X_G+L-R^{bH})\dfrac{\pi_H}{(1-\pi_H)}} - \dfrac{1}{(1+X_G+L-X_B-(1-X_B)R^{tL})\dfrac{\pi_L}{(1-\pi_L)}}\right]}{\left[\ln\{1+X_G+L-R^{bH}\}-\ln\{1+X_G+L-X_B-(1-X_B)R^{tL}\}+\ln\{1+c^r{}_G\}^{\delta}\right]^2} >$$

$$\partial\pi^*/\partial X^r{}_G = \frac{-\ln\{1+c^r{}_G\}^{\delta}\left[\dfrac{(1-X_B)\,\partial R^{tL}/\partial X^r{}_G}{1+X_G+L-X_B-(1-X_B)R^{tL}}\right]}{\left[\ln\{1+X_G+L-R^{bH}\}-\ln\{1+X_G+L-X_B-(1-X_B)R^{tL}\}+\ln\{1+c^r{}_G\}^{\delta}\right]^2}$$

with $\partial R^{tL}/\partial X^r{}_G = \frac{-(1-\pi_L)}{\pi_L(1-X_B)}$

$$= \frac{-\ln\{1+c^r{}_G\}^{\delta}\left[\dfrac{[-(1-\pi_L)/\pi_L]}{1+X_G+L-X_B-(1-X_B)R^{tL}}\right]}{\left[\ln\{1+X_G+L-R^{bH}\}-\ln\{1+X_G+L-X_B-(1-X_B)R^{tL}\}+\ln\{1+c^r{}_G\}^{\delta}\right]^2} > 0$$

$$\partial\pi^*/\partial L = \frac{-\ln\{1+c^r{}_G\}^{\delta}\left[\dfrac{1+(1-\pi_H)/\pi_H}{1+X_G+L-R^{bH}} - \dfrac{1}{1+X_G+L-X_B-(1-X_B)R^{tL}}\right]}{\left[\ln\{1+X_G+L-R^{bH}\}-\ln\{1+X_G+L-X_B-(1-X_B)R^{tL}\}+\ln\{1+c^r{}_G\}^{\delta}\right]^2}$$

$$= \frac{-\ln\{1+c^r{}_G\}^{\delta}\left[\dfrac{1}{\pi_H(1+X_G+L-R^{bH})} - \dfrac{1}{1+X_G+L-X_B-(1-X_B)R^{tL}}\right]}{\left[\ln\{1+X_G+L-R^{bH}\}-\ln\{1+X_G+L-X_B-(1-X_B)R^{tL}\}+\ln\{1+c^r{}_G\}^{\delta}\right]^2} >< 0$$

$$\partial\pi^*/\partial c^r{}_G = \frac{\dfrac{\delta\left[\ln\{1+X_G+L-R^{bH}\}-\ln\{1+X_G+L-X_B-(1-X_B)R^{tL}\}\right]}{(1+c^r{}_G)}}{\left[\ln\{1+X_G+L-R^{bH}\}-\ln\{1+X_G+L-X_B-(1-X_B)R^{tL}\}+\ln\{1+c^r{}_G\}^{\delta}\right]^2} > 0$$

$$\partial\pi^*/\partial\delta = \frac{\begin{bmatrix}\ln\{1+c^r{}_G\}\left[\ln\{1+X_G+L-R^{bH}\}-\ln\{1+X_G+L-X_B-(1-X_B)R^{tL}\}\right] \\ +\ln\{1+c^r{}_G\}^{\delta}\left[\dfrac{(1-\pi_L)X^r{}_G}{\pi_L(1+X_G+L-X_B-(1-X_B)R^{tL})}\right]\end{bmatrix}}{\left[\ln\{1+X_G+L-R^{bH}\}-\ln\{1+X_G+L-X_B-(1-X_B)R^{tL}\}+\ln\{1+c^r{}_G\}^{\delta}\right]^2} > 0$$

<u>Appendix 3: a strictly constrained entrepreneur with $\delta X^r{}_G \geq L$</u>

Both creditors will decide to reorganize in the bad state of nature at time 1 given that $\delta X^r{}_G \geq L$. Consequently, entrepreneurs need no protection against the strict liquidation policy of the bank and the supplier's implicit equity stake does not play any special role. As a result, the high quality strictly constrained entrepreneur cannot use the fraction of debt finance that is bank debt versus trade credit to signal her higher quality. Also, as she is strictly constrained, she cannot bring in additional equity at start-up to signal her higher quality. The only equilibrium that is possible then is a pooling equilibrium where entrepreneurs are indifferent between contracting bank versus supplier finance and where both creditors charge the same price for credit. The price for credit $R^{j\theta}$ (where $j = b$ for the bank; $j = t$ for the supplier) will be set to break even in the credit market:

$$R^{j\theta} = 1/\theta - \frac{(1-\theta)(X_B + \delta X'_G)}{\theta} \qquad \text{with } \theta = \alpha\pi_H + (1-\alpha)\pi_L$$

Appendix 4: constraints on w

In this Appendix, we show that if creditors anticipate that an entrepreneur who contracts (X_B + w) of bank debt will not bring in w once the bad state of nature realizes to ward off liquidation by the bank, it is in the entrepreneur's best interest to contract only X_B rather than (X_B + w) of bank debt at start-up.

As w will not be brought in in the bad state of nature, contracting (X_B + w) of bank debt does not reveal any (positive) information about entrepreneurial quality. Consequently, creditors will not adjust their price for credit and the entrepreneur will not be able to obtain a lower cost of finance by contracting more debt finance as bank debt. Once the bad state of nature realizes, the firm will default against the bank, who will decide to liquidate given that $\delta X'_G < L$. As a result, the entrepreneur is better off when borrowing exclusively from the bank as henceforth only the good state of nature matters. However, the starting point was that the entrepreneur is better off when contracting partial rather than full bank finance. Then, she will have no incentive to contract more bank debt than X_B at start-up. To proof our assertion, we need to show that the following condition holds:

$$\pi_i \ln\left\{1+\left[X_G + L - (X_B + w)R^{b\theta,new} - (1 - X_B - w)R^{t\theta,new} + W\right]\right\} + (1-\pi_i)\ln\left\{1+\left[W\right]\right\}$$
$$< \pi_i \ln\left\{1+\left[X_G + L - X_B R^{b\theta,old} - (1 - X_B)R^{t\theta,old} + W\right]\right\} + (1-\pi_i)\delta \ln\left\{1+\left[c^r{}_G + W\right]\right\}$$
$$+ (1-\pi_i)(1-\delta)\ln\left\{1+\left[W\right]\right\}$$

(expected utility from setting a = (1 – X_B – w) < expected utility from setting a = (1 – X_B))

where:

$$R^{b\theta,old} = 1, \; R^{t\theta,old} = 1/\theta - \frac{(1-\theta)\delta X^r{}_G}{\theta(1-X_B)}$$

The *total* financing cost $R^{\theta,new}$ for €1 of debt finance given that the entrepreneur contracts ($X_B + w$) of bank debt and ($1 - X_B - w$) of trade credit and given that she is not going to bring in w in the bad state – after which the firm will be liquidated – is set such that both the bank and the supplier earn zero rents:[41]

$$R^{\theta,new} = 1/\theta - \frac{(1-\theta)(X_B + L)}{\theta}$$

$\theta = \alpha\pi_H + (1-\alpha)\pi_L$ if the equilibrium is *pooling*

$\theta = \pi_L$ if the equilibrium is *separating*

$$\pi_i \ln\left\{1 + X_G + L - 1/\theta + \frac{(1-\theta)(X_B + L)}{\theta} + W\right\} + (1-\pi_i)\ln\left\{1 + W\right\}$$
$$< \pi_i \ln\left\{1 + X_G + L - X_B - \frac{(1-X_B)}{\theta} + \frac{(1-\theta)\delta X^r{}_G}{\theta} + W\right\} + (1-\pi_i)\delta\ln\left\{1 + c^r{}_G + W\right\}$$
$$+ (1-\pi_i)(1-\delta)\ln\left\{1 + W\right\}$$

The above derived condition always holds, *independent* of whether the equilibrium is pooling or separating:

- If the equilibrium is *pooling*, it must be that both low and high quality entrepreneurs prefer partial bank finance to full bank finance:

$$\pi_i \ln\left\{1 + X_G + L - 1/\theta + \frac{(1-\theta)(X_B + L)}{\theta} + W\right\} + (1-\pi_i)\ln\left\{1 + W\right\}$$
$$< \pi_i \ln\left\{1 + X_G + L - X_B - \frac{(1-X_B)}{\theta} + \frac{(1-\theta)\delta X^r{}_G}{\theta} + W\right\} + (1-\pi_i)\delta\ln\left\{1 + c^r{}_G + W\right\} \qquad i = H, L$$
$$+ (1-\pi_i)(1-\delta)\ln\left\{1 + W\right\}$$

(expected utility from setting a = 0 < expected utility from setting a = (1 – X_B))

which is identical to the above derived condition, which therefore is <u>satisfied</u>.

- If the equilibrium is *separating*, it must be that low quality entrepreneurs prefer a financial structure where they are identified as low quality to a financial structure where they are identified as high quality:

[41] Note that here, we do not split up the total financing cost into a price for bank debt $R^{b\theta,new}$ and a price for trade credit $R^{t\theta,new}$: in order to be able to do so, we should make some assumptions on the relative priority of bank debt and trade credit and on the entrepreneur's distribution of X_B among the creditors at time 1, while these assumptions are irrelevant for the remaining of our paper since priority issues do not impact on the results of our paper. See also footnote 27.

$$\pi_L \ln\left\{1 + X_G + L - 1 * R^{bH} + W\right\} + (1-\pi)\ln\left\{1 + W\right\}$$
$$< \pi_L \ln\left\{1 + X_G + L - X_B * R^{bL} - (1 - X_B) * R^{tL} + W\right\} + (1-\pi_L)\delta \ln\left\{1 + c^r{}_G + W\right\}$$
$$+ (1-\pi_L)(1-\delta)\ln\left\{1 + W\right\}$$

(expected utility from setting a = 0 < expected utility from setting a = (1 – X_B))

where:

$$R^{bH} = 1/\pi_H - \frac{(1-\pi_H)(X_B + L)}{\pi_H}$$

$$R^{bL} = 1,\ R^{tL} = 1/\pi_L - \frac{(1-\pi_L)\delta X^r{}_G}{\pi_L(1 - X_B)}$$

$$\pi_L \ln\left\{1 + X_G + L - 1/\pi_H + \frac{(1-\pi_H)(X_B + L)}{\pi_H} + W\right\} + (1-\pi_L)\ln\left\{1 + W\right\}$$
$$< \pi_L \ln\left\{1 + X_G + L - X_B - \frac{(1 - X_B)}{\pi_L} + \frac{(1-\pi_L)\delta X^r{}_G}{\pi_L} + W\right\} + (1-\pi_L)\delta \ln\left\{1 + c^r{}_G + W\right\}$$
$$+ (1-\pi_L)(1-\delta)\ln\left\{1 + W\right\}$$

As $\ln\left\{1 + X_G + L - X_B - \frac{(1-X_B)}{\pi_L} + \frac{(1-\pi_L)\delta X^r{}_G}{\pi_L} + W\right\} < \ln\left\{1 + X_G + L - X_B - \frac{(1-X_B)}{\theta} + \frac{(1-\theta)\delta X^r{}_G}{\theta} + W\right\}$ and $\ln\left\{1 + X_G + L - 1/\pi_H + \frac{(1-\pi_H)(X_B+L)}{\pi_H} + W\right\} > \ln\left\{1 + X_G + L - 1/\theta + \frac{(1-\theta)(X_B+L)}{\theta} + W\right\}$, it follows:

$$\pi_L \ln\left\{1 + X_G + L - 1/\theta + \frac{(1-\theta)(X_B + L)}{\theta} + W\right\} + (1-\pi_L)\ln\left\{1 + W\right\}$$
$$< \pi_L \ln\left\{1 + X_G + L - X_B - \frac{(1 - X_B)}{\theta} + \frac{(1-\theta)\delta X^r{}_G}{\theta} + W\right\} + (1-\pi_L)\delta \ln\left\{1 + c^r{}_G + W\right\}$$
$$+ (1-\pi_L)(1-\delta)\ln\left\{1 + W\right\}$$

which is identical to the above derived condition, which therefore is satisfied.

Appendix 5: incentive conditions

Both high and low quality entrepreneurs have no incentive to bring in more equity than the legal minimum if the following conditions are satisfied for a high, respectively a low quality entrepreneur:

$$\pi_H \ln\left\{1 + \left[X_G + L - R^{bH,old} + W\right]\right\} + (1-\pi_H)\ln\left\{1 + [W]\right\}$$
$$> \pi_H \ln\left\{1 + \left[X_G + L - (1-w)R^{bH,new} + (W - w)\right]\right\} + (1-\pi_H)\ln\left\{1 + [W - w]\right\}$$

(expected utility from bringing in the minimum equity contribution required by law
> expected utility from bringing in an amount of equity w in addition to the minimum required by law)

where:

$$R^{bH,old} = 1/\pi_H - \frac{(1-\pi_H)(X_B + L)}{\pi_H}$$

$$R^{bH,new} = 1/\pi_H - \frac{(1-\pi_H)(X_B + L)}{\pi_H(1-w)}$$

which can be simplified to:

$$\pi_H \ln\left\{ 1 + X_G + L - 1/\pi_H + \frac{(1-\pi_H)(X_B+L)}{\pi_H} + W \right\} + (1-\pi_H)\ln\{1+W\}$$

$$> \pi_H \ln\left\{ 1 + X_G + L - 1/\pi_H + \frac{(1-\pi_H)(X_B+L)}{\pi_H} + W + w(1-\pi_H)/\pi_H \right\} + (1-\pi_H)\ln\{1+W-w\}$$

which is satisfied

and

$$\pi_L \ln\{1 + [X_G + L - X_B R^{bL,old} - (1-X_B)R^{tL,old} + W]\} + (1-\pi_L)\delta \ln\{1+[c^r{}_G + W]\}$$
$$+ (1-\pi_L)(1-\delta)\ln\{1+[W]\}$$
$$> \pi_L \ln\{1 + [X_G + L - X_B R^{bL,new} - (1-X_B-w)R^{tL,new} + (W-w)]\}$$
$$+ (1-\pi_L)\delta \ln\{1+[c^r{}_G + (W-w)]\} + (1-\pi_L)(1-\delta)\ln\{1+[W-w]\}$$

(expected utility from bringing in the minimum equity contribution required by law

> expected utility from bringing in an amount of equity w in addition to the minimum required by law)

where:

$R^{tL,old}$

$$R^{bL,old} = 1,\ R^{tL,old} = 1/\pi_L - \frac{(1-\pi_L)\delta X^r{}_G}{\pi_L(1-X_B)}$$

$$R^{bL,new} = 1,\ R^{tL,new} = 1/\pi_L - \frac{(1-\pi_L)\delta X^r{}_G}{\pi_L(1-X_B-w)}$$

which can be simplified to:

$$\pi_L \ln\left\{ 1 + X_G + L - X_B - \frac{(1-X_B)}{\pi_L} + \frac{(1-\pi_L)\delta X^r{}_G}{\pi_L} + W \right\} + (1-\pi_L)\delta\ln\{1+c^r{}_G + W\} + (1-\pi_L)(1-\delta)$$

$$> \pi_L \ln\left\{ 1 + X_G + L - X_B - \frac{(1-X_B)}{\pi_L} + \frac{(1-\pi_L)\delta X^r{}_G}{\pi_L} + W + w\frac{(1-\pi_L)}{\pi_L} \right\}$$
$$+ (1-\pi_L)\delta\ln\{1+c^r{}_G + W - w\} + (1-\pi_L)(1-\delta)\ln\{1+W-w\}$$

which is satisfied

A low quality entrepreneur has no incentive to contract more bank debt than X_B if the following condition is satisfied:

$$\pi_L \ln\left\{1+\left[X_G + L - (X_B + w)R^{bL,new} - (1-X_B-w)R^{tL,new} + W\right]\right\} + (1-\pi_L)\delta \ln\left\{1+\left[c^r{}_G + (W-w)\right]\right\}$$
$$+ (1-\pi_L)(1-\delta)\ln\left\{1+\left[W-w\right]\right\}$$
$$< \pi_L \ln\left\{1+\left[X_G + L - X_B R^{bL,old} - (1-X_B)R^{tL,old} + W\right]\right\} + (1-\pi_L)\delta \ln\left\{1+\left[c^r{}_G + W\right]\right\}$$
$$+ (1-\pi_L)(1-\delta)\ln\left\{1+\left[W\right]\right\}$$

(expected utility from setting (1 – a) = (X_B + w) < expected utility from setting (1 – a) = X_B)

where:

$R^{tL,old}$

$$R^{bL,old} = 1,\; R^{tL,old} = 1/\pi_L - \frac{(1-\pi_L)\delta X^r{}_G}{\pi_L(1-X_B)}$$
$$R^{bL,new} = 1,\; R^{tL,new} = 1/\pi_L - \frac{(1-\pi_L)\delta X^r{}_G}{\pi_L(1-X_B-w)}$$

which can be simplified to:

$$\pi_L \ln\left\{1+X_G+L-X_B-\frac{(1-X_B)}{\pi_L}+\frac{(1-\pi_L)\delta X^r{}_G}{\pi_L}+W+\frac{w(1-\pi_L)}{\pi_L}\right\}$$
$$+(1-\pi_L)\delta\ln\left\{1+c^r{}_G+W-w\right\}+(1-\pi_L)(1-\delta)\ln\left\{1+W-w\right\}$$
$$<\pi_L \ln\left\{1+X_G+L-X_B-\frac{(1-X_B)}{\pi_L}+\frac{(1-\pi_L)\delta X^r{}_G}{\pi_L}+W\right\}$$
$$+(1-\pi_L)\delta\ln\left\{1+c^r{}_G+W\right\}+(1-\pi_L)(1-\delta)\ln\left\{1+W\right\}$$

which is satisfied.

Appendix 6: a weakly constrained entrepreneur with $\delta X^r{}_G \geq L$

Following default at time 1, the impaired financial claims will be reorganized for sure, without entrepreneurs having to bring in additional equity given that $\delta X^r{}_G \geq L$. As a result, external financiers anticipate that entrepreneurs, who act in their self-interest, will never bring in additional equity at time 1 once the bad state of nature realizes.

However, the fact that the entrepreneur is no longer constrained at $W = 0$ *might* have implications for capital structure in terms of total finance that is debt versus equity: the entrepreneur no longer needs to limit her equity contribution to the minimum required by law. By bringing in more equity at start-up, a high quality entrepreneur might be able to dissociate herself from lower quality ones. Depending on whether or not the high quality entrepreneur only brings in the legal minimum, a pooling respectively separating equilibrium can result. In the resulting separating equilibrium, high quality entrepreneurs borrow exclusively from the bank because only the bank's price of credit will reflect their credit risk. As the supplier henceforth only attracts low quality entrepreneurs, he will adjust his price for trade credit upwards. Then, low quality entrepreneurs become indifferent between contracting bank debt, trade credit or some combination of both. In the separating equilibrium, we find that when π_L lies in the interval $[0, \pi^*[$ and π_H lies in the interval $]\pi^*, 1]$, where

$$\pi^* = \frac{\ln\left\{1+c'_G+W\right\}^{\delta} - \ln\left\{1+c^r{}_G+W-w\right\}^{\delta} + \ln\left\{1+W\right\}^{(1-\delta)} - \ln\left\{1+W-w\right\}^{(1-\delta)}}{\begin{bmatrix} \ln\left\{1+X_G+L-(1-w)R^{bH}+W-w\right\}+\ln\left\{1+c'_G+W\right\}^{\delta}+\ln\left\{1+W\right\}^{(1-\delta)} \\ -\ln\left\{1+X_G+L-R^{jL}+W\right\}+\ln\left\{1+c^r{}_G+W-w\right\}^{\delta}-\ln\left\{1+W-w\right\}^{(1-\delta)} \end{bmatrix}}$$

$$R^{jl} = 1/\pi_L - \frac{(1-\pi_L)(X_B+\delta X^r{}_G)}{\pi_L} \qquad \text{j = b, t}$$

$$R^{bH} = 1/\pi_H - \frac{(1-\pi_H)(X_B+\delta X^r{}_G)}{\pi_H(1-w)} \quad (\text{if } (1-w)R^{jH} > X_B+\delta X^r{}_G) \quad or \quad R^{jH} = 1 \quad (\text{if } (1-w)R^{jH} \le X_B+\delta X^r{}_G)$$

it is optimal for the low quality entrepreneur to bring in only minimum equity at start-up, while for the high quality entrepreneur, it is optimal to contribute some equity w beyond the legal minimum.

As entrepreneurs are risk averse, the high quality weakly constrained entrepreneur will choose the smallest w that allows dissociation from low quality entrepreneurs. Then, w is set according to the following equality:

$$\begin{aligned} &\pi_H \ln\left\{1+X_G+L-R^{jL}+W\right\}+(1-\pi_H)\delta\ln\left\{1+\left[c'_G+W\right]\right\}+(1-\pi_H)(1-\delta)\ln\left\{1+[W]\right\} \\ &= \pi_H \ln\left\{1+X_G+L-(1-w)R^{bH}+(W-w)\right\}+(1-\pi_H)\delta\ln\left\{1+\left[c'_G+(W-w)\right]\right\} \\ &\quad +(1-\pi_H)(1-\delta)\ln\left\{1+[W-w]\right\} \end{aligned}$$

As w is a nonlinear function of the different parameters of the model, we are unable to give a closed-form solution formula for w. Therefore, below, we give an overview of some of our simulations used to determine w. The conditions that are imposed on the solution for w are: $w \le W$ and $w \ge 0$. We find that w is *decreasing* in π_L, X_G, X_B, L, $X^r{}_G$ and δ and *increasing* in π_H, $c^r{}_G$ and W. This implies that entrepreneurs of higher quality, with higher control rents, more personal wealth, projects that have a lower payoff (X_G, X_B and/or $X^r{}_G$) or liquidation value and a lower probability that the good state of nature will realize at time 2 following default at time 1 need to give a stronger quality signal in order for their signal to be credible.

Varying parameter	π_L	π_H	X_G	X_B	L	X^r_G	δ	c^r_G	W	Solution for w ($w \in [0, W]$)
π_L	0.7	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	0
	0.6	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	0.131142
	0.5	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	0.289627
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	0.48886
	0.3	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	no feasible solution
	0.2	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	no feasible solution
	0.1	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	no feasible solution
π_H	0.4	1.0	3	0.5	0.2	0.4	0.6	0.3	0.7	no feasible solution
	0.4	0.9	3	0.5	0.2	0.4	0.6	0.3	0.7	no feasible solution
	0.4	0.8	3	0.5	0.2	0.4	0.6	0.3	0.7	no feasible solution
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	0.48886
	0.4	0.6	3	0.5	0.2	0.4	0.6	0.3	0.7	0.281802
	0.4	0.5	3	0.5	0.2	0.4	0.6	0.3	0.7	0.127781
	0.4	0.4	3	0.5	0.2	0.4	0.6	0.3	0.7	0
X_G	0.4	0.7	5.0	0.5	0.2	0.4	0.6	0.3	0.7	0.281039
	0.4	0.7	4.5	0.5	0.2	0.4	0.6	0.3	0.7	0.315594
	0.4	0.7	4.0	0.5	0.2	0.4	0.6	0.3	0.7	0.359114
	0.4	0.7	3.5	0.5	0.2	0.4	0.6	0.3	0.7	0.415097
	0.4	0.7	3.0	0.5	0.2	0.4	0.6	0.3	0.7	0.48886
	0.4	0.7	2.5	0.5	0.2	0.4	0.6	0.3	0.7	0.588277
	0.4	0.7	2.0	0.5	0.2	0.4	0.6	0.3	0.7	no feasible solution
X_B	0.4	0.7	3	0.8	0.2	0.4	0.6	0.3	0.7	no feasible solution
	0.4	0.7	3	0.7	0.2	0.4	0.6	0.3	0.7	0.130661
	0.4	0.7	3	0.6	0.2	0.4	0.6	0.3	0.7	0.322109
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	0.48886
	0.4	0.7	3	0.4	0.2	0.4	0.6	0.3	0.7	0.636691
	0.4	0.7	3	0.3	0.2	0.4	0.6	0.3	0.7	no feasible solution
	0.4	0.7	3	0.2	0.2	0.4	0.6	0.3	0.7	no feasible solution
L	0.4	0.7	3	0.5	0.24	0.4	0.6	0.3	0.7	0.48214
	0.4	0.7	3	0.5	0.22	0.4	0.6	0.3	0.7	0.485478
	0.4	0.7	3	0.5	0.20	0.4	0.6	0.3	0.7	0.48886
	0.4	0.7	3	0.5	0.18	0.4	0.6	0.3	0.7	0.492282
	0.4	0.7	3	0.5	0.16	0.4	0.6	0.3	0.7	0.495746
	0.4	0.7	3	0.5	0.14	0.4	0.6	0.3	0.7	0.499254
	0.4	0.7	3	0.5	0.12	0.4	0.6	0.3	0.7	0.502797
X^r_G	0.4	0.7	3	0.5	0.2	0.8	0.6	0.3	0.7	0.045124
	0.4	0.7	3	0.5	0.2	0.7	0.6	0.3	0.7	0.171318
	0.4	0.7	3	0.5	0.2	0.6	0.6	0.3	0.7	0.28605
	0.4	0.7	3	0.5	0.2	0.5	0.6	0.3	0.7	0.391397
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	0.48886
	0.4	0.7	3	0.5	0.2	0.3	0.6	0.3	0.7	0.579561
	0.4	0.7	3	0.5	0.2	0.2	0.6	0.3	0.7	0.664345
δ	0.4	0.7	3	0.5	0.2	0.4	0.9	0.3	0.7	0.311774
	0.4	0.7	3	0.5	0.2	0.4	0.8	0.3	0.7	0.37735
	0.4	0.7	3	0.5	0.2	0.4	0.7	0.3	0.7	0.435989
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	0.48886
	0.4	0.7	3	0.5	0.2	0.4	0.5	0.3	0.7	0.536849
	0.4	0.7	3	0.5	0.2	0.4	0.4	0.3	0.7	0.580655
	0.4	0.7	3	0.5	0.2	0.4	0.3	0.3	0.7	0.62086
c^r_G	0.4	0.7	3	0.5	0.2	0.4	0.6	0.7	0.7	0.565256

	0.4	0.7	3	0.5	0.2	0.4	0.6	0.6	0.7	0.547093
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.5	0.7	0.528311
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.4	0.7	0.508895
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	0.48886
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.2	0.7	0.468219
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.1	0.7	0.446988
W	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.9	0.534756
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.8	0.511951
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.7	0.48886
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.6	0.465475
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.5	0.441778
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.4	0.41775
	0.4	0.7	3	0.5	0.2	0.4	0.6	0.3	0.3	0.393368